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ABSTRACT

Established in 1956, the National Library of Medicine (NLM) was charged to acquire and preserve books, periodicals, prints, films, recordings, and other library materials pertinent to medicine. Since the establishment of the NLM, significant effort has been devoted to carrying out preservation responsibilities. In 1983, the Library Operations (LO) senior staff included the development and implementation of a preservation program of the biomedical literature as one of four broad objectives in the LO 1984-88 strategic plan. A senior preservation planning team was appointed to analyze the state of the NLM collections, its environment, and use, and to present available options for preservation. The planning process used for this project was modeled on a self-study procedure developed by the Office of Management Studies (OMS) of the Association for Research Libraries (ARL) and described in "Preservation Planning Program: An Assisted Self-Study Manual for Libraries." This report documents the team's findings and presents a recommended plan of action for the library. Following an introduction and executive summary, the report covers: collection condition, physical facilities and environment, collection use and maintenance, present level of preservation activity at NLM, current state of preservation technology, external factors affecting NLM's preservation plan, and recommended strategies for preservation. Six appendices are included: a background paper; a list of task force members; procedures used in surveying the physical condition of the collection; indoor pollutant measurements of sulfur dioxide, nitrogen dioxides, and ozone; draft preservation policy; and rationale and functions of the proposed preservation section. A brief list of references completes the report. (THC)

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PRESERVATION OF THE BIOMEDICAL LITERATURE:

A Plan for the National Library of Medicine

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I. EXECUTIVE SUMMARY

Introduction

The National Library of Medicine Act of 1956 (P. L. 84-941) established the Library and charged it "to acquire and preserve books, periodicals, prints, films, recordings, and other library materials pertinent to medicine." In the years since the establishment of the Library, significant effort has been devoted to carrying out NLM's preservation responsibilities. NLM currently devotes 11 FTEs and nearly one million dollars annually to preservation activities. The Library has archival copies of many significant items in its collection; a storage plan which accommodates projected growth of the collection through the year 2000; generally favorable conditions for processing, storing, and using library materials; and an official NLM Board of Regents' policy governing NLM's preservation activities.

Despite these achievements, NLM must take a more comprehensive approach to preservation of the biomedical literature if it is to carry out its statutory mandate successfully. Recognizing the need for greater focus on NLM's preservation responsibility, in 1983 Library Operations (LO) senior staff included the development and implementation of a program for the preservation of the biomedical literature as one of the four broad objectives in the LO strategic plan for 1984-88. As a first step toward developing a formal preservation program, the Associate Director, LO appointed a senior Preservation Planning Team on August 29, 1984.

With assistance from over thirty staff members throughout the Library, the Preservation Team has analyzed the state of the NLM collection, its environment, and use, and available options for preservation. This report documents the Team's findings and presents a recommended plan of action for the Library.

Condition of the Collection

The physical condition of library materials is a function of three principal factors: (1) the substances used in their manufacture and how these substances change with age; (2) the environmental conditions in which the materials are housed; and (3) how, and how often, the materials are handled. Most of the 3.3 million items presently in the NLM collection, like most of the materials in other research libraries, are composed of substances that predispose them toward rapid deterioration. The degree of deterioration varies from library to library, however, depending on the relative age and quality of the materials included in the collection and the storage and use conditions to which the materials have been subjected.

Random samples of the various elements in the NLM collection revealed that approximately 8.8% or an estimated 113,000 volumes in the paper-based collections are brittle. By taking action immediately, NLM

can ensure preservation of the content of the endangered volumes and also extend the life of the remainder of the collection. Delays may lead to the loss of already embrittled materials and an increase in the number of brittle items requiring very expensive preservation techniques.

Physical Facilities And Environment

There are five environmental factors which affect the longevity of library materials: temperature and relative humidity, atmospheric pollutants, light, mold, insects and rodents. The NLM Library building was surveyed for all factors.

Although some problems were discovered, in general the environmental conditions in the Library are good, and they probably can be improved without great expense. The construction of the Library, with relatively few windows and three floors below ground, makes it easier to maintain appropriate temperatures for the collection and to minimize the amount of ultra-violet radiation. Concern for the preservation of the collection is evident in the design of the building and in its heating and air-conditioning system.

Collection Use and Maintenance

The amount and nature of physical processing, handling and use of Library materials by staff and patrons have an effect (either positive or negative) on the life of those materials. The mission of any library is almost inevitably in conflict with preservation of its contents, for materials are acquired, organized and stored primarily to be used, and use necessarily takes a toll on condition. Therefore, there will always be a tension and compromise between the need to preserve material and to make them readily available to the Library's users.

The results of the survey of the physcial condition of items in the NLM collection indicate that current processing and use practices are not having a serious negative effect on the Library's materials. This does not mean, however, that there is no room for improvement in the way NLM's collection is handled by staff and users. The process of observing, documenting and discussing the use and processing practices that can affect the Library's collections has already caused staff members to be more preservation conscious and alert to potentially damaging handling policies and techniques. Some physical damage is unavoidable in a service organization where use is expected and encouraged, but steps can be taken to reduce even further damage during processing and after the materials are in the users' hands.

Current State of Preservation Technology

In the broadest sense, any activity which extends the life of library materials is a preservation technique. This is why the enhancement of the environment in which materials are stored and improvements in the way materials are handled are important to preservation programs. Using a narrower interpretation, however, a preservation technique is something which improves the intrinsic durability of an item or creates a copy of it in a more durable medium. Relatively few such techniques exist, particularly for mass preservation of the post-1850 paper-based materials most at risk. Fortunately, recent expansion of interest in preservation among research libraries has sparked research in mass preservation techniques. Although currently available options are still very limited in number, there is promise of better things to come.

The major techniques that are currently available, or are the subject of research activity, are: mass deacidification; strengthening of brittle paper; mass disk storage; microfilming; film-to-film transfer; a variety of manual methods for rare books, manuscripts, and prints and photographs; and the acquisition of materials in archival formats.

When it becomes generally available, presumably in two to three years, mass deacidification will probably be the cheapest alternative for preservation of paper-based materials. While it is not useful for materials that are already brittle, it is a suitable technique for the bulk of NLM's paper-based collections. The newer materials are at the time they are deacidified, the more they can benefit from the process.

Mass disk storage has exceptional use characteristics, including random access, simultaneous use by multiple users, and the ability to be linked directly to automated bibliographic records. The preservation characteristics of disks are not fully understood, however, and require further research. The results of such research are needed before accurate total cost estimates for preservation on disk can be developed.

Of the preservation techniques suitable for the mass of NLM's printed collections, only microfilming is available to NLM today. Microfilm is very space efficient if the original is not retained after filming, but it is also unwieldy to use. This may not be a serious problem for older materials that receive relatively infrequent use.

Other Factors Affecting NLM's Preservation Program

NLM's preservation program must take into account a number of external factors affecting the U.S. information and biomedical communities. These include publishing trends; developments in the concept of intellectual property rights; changes in the ways health professionals acquire and use information; and the emergence of preservation as a critical concern in research libraries, which in turn has led to increased emphasis on cooperative library activities and significant developments in preservation technology.

Recommended Strategies for Preservation at NLM

An examination of the current condition of the NLM collection, the environment in which it is stored, the way its materials are processed and used, and the present level of preservation activity has revealed a preservation problem that can be solved if NLM takes immediate action to establish a comprehensive preservation program. In many respects, NLM is in a much better position than other U.S. research libraries which have such huge numbers of brittle materials that there is almost no possibility of saving them at all. Due to the relatively good condition of the NLM collection and its manageable size, NLM has the opportunity to fulfill its mandate to preserve the biomedical literature.

After careful evaluation of available options, the Preservation Planning Team recommends that NLM take the following actions to create a preservation program capable of ensuring the long-term availability of the scholarly record for biomedicine.

A. MODIFY THE NLM BOARD OF REGENTS POLICY ON PRESERVATION

The NLM Board of Regents' policy on preservation of the collection should be modified to link NLM's preservation program more explicitly to its collection development guidelines, to clarify the Library's responsibility for the preservation of the content as opposed to the format of the biomedical literature, and to define NLM's role in assisting the preservation of significant biomedical literature held by other U.S. libraries.

The Preservation Planning Team has prepared a draft policy statement for consideration by the Director, NLM and the Board of Regents. The full text of this draft statement is included in Appendix 5 of the report.

B. ESTABLISH A NEW ORGANIZATIONAL UNIT TO DIRECT NLM'S PRESERVATION PROGRAM

NLM's existing preservation organization, while appropriate for the level of preservation activity currently underway, is inadequate to handle the expansion of preservation functions that the Library must undertake to ensure the preservation of the scholarly biomedical literature. The Preservation Planning Team recommends that a Preservation Section be established within the Reference Services Division to provide an operational focus for NLM's preservation activities and assume direct responsibility for many of them. Given present constraints, the new Section must be developed by reallocating existing staff and positions. It should also continue NLM's current practice of contracting out most of the actual physical preservation or copying of materials to archival formats.

C. EXPAND THE LEVEL OF PRESERVATION ACTIVITY AT NLM

Because NLM has the largest collection of biomedical literature in the world, preservation of the materials held by the Library represents a significant step toward preservation of the entire scholarly record in the field of medicine and health. With the completion of this comprehensive study of internal and external factors affecting preservation of the NLM collection and the adoption of a preservation policy, the Library should expand its preservation program to achieve by the year 2005 the goal of a preservation copy for every item in the NLM collection that falls within the core biomedical literature that NLM collects comprehensively or within the subjects related to medicine and health that NLM collects at the research level. NLM should take the following specific steps toward this goal.

Mass Deacidification

Beginning in FY 1988, NLM should deacidify 100,000 volumes annually, including all incoming print materials that would benefit from this treatment and making up the remainder from items in the retrospective collection. Depending on the number of new materials acquired on acid-free paper or in non-print form each year, it will take 18-20 years to deacidify the entire retrospective collection that would benefit from this treatment, while also treating all appropriate incoming materials. The cost, depending on the mix of new and old materials, will range from $370,000 to $400,000 annually (in FY 1985 dollars) until all the retrospective collection has been treated. These cost figures are based on the use of an existing facility, and exclude any charges to defray the cost of facility construction.

To make certain that mass deacidification services at the required level are available to the Library by 1989, NLM should negotiate with LC for a firm commitment for NLM use of the mass deacidification facility at Frederick. If sufficient capacity cannot be made available at the LC facility, NLM should work with other research libraries and/or commercial companies to ensure the development of adequate deacidification service for the NLM collection.

Microfilming

Using contract support for preparation and an outside filmer, NLM should microfilm all brittle monographs and serial volumes in subjects it collects at the comprehensive or research level during FY 1986 - 89. Expenditures for this program should be phased as follows: $600,000 in FY 1986; $1 million per year in FY 1987 through FY 1989. The Library should assume that microfilming any post-1906 embrittled materials in order to preserve them represents a "fair use" of the materials.

Treatment of brittle pamphlets and theses should be deferred pending resolution of the more immediate problem of how the Library is to provide bibliographic control for these items.

In 1988/89, NLM should reassess any further use of preservation microfilming based on the results of research in techniques for the preservation use of mass disk storage. Previously microfilmed images can be transferred to disk if this seems advisable at a later date.

Preservation of Special Historical Collections

NLM should allocate at least $200,000 per year to preservation of special collections for the five-year period from FY 1986 - FY 1990. In 1988/89, NLM should be in a position to estimate the level of funding required for continuing maintenance and treatment of new acquisitions for these special collections.

D. CONTINUE RESEARCH ON THE PRESERVATION CHARACTERISTICS OF OPTICAL DISKS

Because of the great potential of optical disk as a preservation medium, NLM should continue to contribute to the development of knowledge about the preservation characteristics of this technology. The prototype Electronic Document Storage and Retrieval (EDSR) system developed in the Lister Hill National Center for Biomedical Communications (LHNCBC) should be used as a laboratory test bed for relevant research projects. LHNCBC budget plans for the next few years includes appropriate funding for this activity. To ensure that the greatest amount of useful information is obtained in the shortest time frame, NLM's research efforts in optical disk technology should be closely coordinated with those of the Library of Congress, the National Archives, the National Bureau of Standards and other interested institutions.

E. ENCOURAGE PUBLICATION IN ARCHIVAL FORMATS

Publication of the scholarly literature on acid-free paper or in other archival formats will lessen the necessity for large-scale treatment of the prospective literature. To this end, NLM should launch a campaign to convince biomedical editors, societies, and publishers of the benefits of publication in archival formats. This campaign should involve a combination of direct appeals by NLM and cooperative efforts with other national libraries and library associations.

F. IMPROVE CONDITIONS FOR STORAGE AND USE OF THE NLM COLLECTION

Proper storage and handling of library materials will extend their life. An examination of storage and use conditions at NLM has revealed that in general NLM's collection is stored in a benign environment and is handled with reasonable care. Steps should be taken, however, to ensure that this generally favorable situation continues and that specific problems are corrected.

G. INITIATE AND PARTICIPATE IN COOPERATIVE PROGRAMS FOR THE PRESERVATION OF THE BIOMEDICAL LITERATURE

Although NLM's first priority is the preservation of its own collection of materials collected at the comprehensive and research levels, it also has an obligation to engage in cooperative activities which will ensure the preservation of materials pertinent to medicine held by other libraries and will contribute to a national preservation program. While the emerging national program provides an infrastructure in which to fit the preservation of the biomedical literature, it does not presently address coverage of the biomedical area. NLM must assume the responsibility for the development of a plan to fill this gap.

H. RE-EVALUATE NLM'S PRESERVATION PROGRAM PERIODICALLY

Like other NLM programs, the preservation operation will be monitored through regular reporting mechanisms and the program review that accompanies budget preparation and approval. Given the new emphasis to be placed on preservation, however, NLM should also perform a broader review of progress toward the goal of preservation of the biomedical literature at approximately three-year intervals. During this review, NLM should reassess its preservation assumptions and strategies in light of the current and future information needs of the Library's users and developments in preservation technology.

II. INTRODUCTION

The National Library of Medicine Act of 1956 (P. L. 84-941) established the Library and charged it "to acquire and preserve books, periodicals, prints, films, recordings, and other library materials pertinent to medicine." The Act further authorized the Surgeon General to "Exchange, destroy, or otherwise dispose of any books, periodicals, films and other library materials not needed for the permanent use of the Library." Taken together these two clauses clearly give NLM a mandate to preserve the biomedical literature irrespective of its format and also provide the Library with the discretion to select among the materials in the collection those which should be permanently retained and preserved.

In the years since the establishment of the Library, significant efforts have been devoted to carrying out NLM's preservation responsibilities. Due in large part to the leadership of Albert Berkowitz, former Chief, Reference Services Division, the Library has archival copies of some of the most significant items in its collection; a storage plan which accommodates projected growth of the collection through the year 2000; generally favorable conditions and practices for processing, storing, and using library materials; and an official NLM Board of Regents' policy governing NLM's preservation activities. The text of this policy is as follows:

> In accordance with the terms of the NLM Act and the clearly expressed intent of Congress, the fundamental responsibility of the National Library of Medicine is to preserve permanently its collection of books, periodicals, and other library materials pertinent to medicine, without respect to the practices of other institutions.
>
> Means of preservation may include:
>
> A. Preservation of the original.
>
> B. The purchase of library materials in microform or other formats provided an examination of adequate samples affords satisfactory evidence that the film or other medium meets NLM standards for archival quality.
>
> C. Replication of material in the collection through microphotography, or other means as the Director may determine, using new methods made practicable by advancing technology.
>
> The Director will establish criteria to determine priority of selection for preservation. Items in the collection will be retained in the original form as long as they remain useful.
>
> The Library should continue to monitor the development of technologies which offer alternatives to microphotography for

> the preservation of information and should participate in such research, development, testing, and evaluation.

Despite these important accomplishments, NLM must take a more comprehensive approach to preservation of the biomedical literature if it is to carry out its statutory mandate successfully. Like the collections of other research libraries, NLM's printed collections contain the seeds of their own destruction in the form of high-acid content paper which, over time, discolors, becomes embrittled, and finally disintegrates. In addition, the Library faces special problems related to the conservation and preservation of audiovisual programs, archival microfilms, and historical motion pictures and the History of Medicine Division's manuscripts, older printed works, prints and photographs. Preservation of the scholarly record is one of the most important challenges facing research libraries today, requiring significant expenditures of resources, the interest and involvement of all staff who process or use the collection, active cooperation among many institutions, and new organizational approaches.

In 1983, Library Operations (LO) senior staff developed a strategic plan for 1984-88 which includes as one of its four broad objectives:

> to develop and implement a program for the preservation of the biomedical literature.

As a first step toward developing a formal preservation program, the Associate Director for Library Operations appointed a senior Preservation Planning Team on August 29, 1984.

The Team was given the following charge:

1. Assess the current physical state of the collection.

2. Assess the conditions under which the collection is used, processed, and stored.

3. Examine current preservation activities in all LO components.

4. Identify and evaluate available preservation techniques.

5. Identify current and potential cooperative preservation activities.

6. Develop a plan for the preservation of the NLM collection which includes recommendations for:

   a. organizational responsibility for NLM preservation activities

   b. general guidelines for selecting items to be preserved and assigning preservation priorities

   c. methods for preservation of various parts of the

collection including cost data and suggested schedules

d. necessary changes to environmental conditions and processing and use practices

e. cooperative activities NLM should participate in or initiate

The planning process used for this project was modeled on a self-study procedure developed by the Office of Management Studies (OMS) of the Association for Research Libraries (ARL) and described in Preservation Planning Program: An Assisted Self-Study Manual for Libraries. NLM contracted with OMS for assistance in developing the plan and the results of NLM's effort will be shared with the ARL and biomedical library communities. Ms. Jutta Reed-Scott served as principal OMS consultant to NLM for the project.

The planning process consisted of three phases. During the first phase, the Preservation Planning Team reviewed basic preservation issues and assembled background information about the library. This material was included in a background paper entitled "Preservation at the National Library of Medicine" (Appendix 1), completed in November, 1984. The background paper provided a context for the examination of the Library's preservation needs, established a series of Task Forces (including the identification of participants and specific charges), and outlined a schedule for the planning process.

The second phase involved seven Task Forces gathering and analyzing data and developing recommendations in several specific areas affecting preservation. Task Forces were assigned to assess the physical condition of the collection, environmental conditions affecting the collection, processing and use practices, preservation techniques, organizational responsibility for preservation, cooperative preservation activities, and the adequacy of the current NLM disaster recovery plan. A list of all Task Force members appears in Appendix 2.

In the third and final phase, the Preservation Planning Team has studied information assembled by the Task Forces, weighed alternative approaches, and developed this report with its recommended plan of action.

III. CONDITION OF THE COLLECTION

The physical condition of library materials is a function of three principal factors: (1) the substances used in their manufacture and how these substances change with age; (2) the environmental conditions in which the materials are housed; and (3) how, and how often, the materials are handled. The majority of library materials in existence today are printed works that were published after 1850. Mass produced, alum-rosin sized ground wood paper entered commerce around 1850 and most books and journals published since 1870 have been printed on it. Although there are varying degrees of quality in this paper, all of it is less strong than paper with cotton fibers because of the short fibers in wood pulp, and all is destined to disintegrate because of its relatively high-acid content. The condition of high-acid content paper begins deteriorating rapidly as soon as it is produced. The rate of deterioration slows as the paper becomes progressively embrittled. Although acidic paper may be the principal cause of the deterioration of library collections, other substances, such as nitrate-based film, also present significant preservation problems.

Most of the materials presently in the NLM collection, like most of the materials in other research libraries, are composed of substances that predispose them toward rapid deterioration. The degree of deterioration varies from library to library, however, depending on the relative age and quality of the materials included in the collection and the storage and use conditions to which the materials have been subjected. Since no reliable conclusions about the state of the NLM collection could be drawn from studies of other collections, an obvious prerequisite to the development of a preservation plan for the NLM collection was the gathering and analysis of data on the present state of NLM's library materials. Consequently one of the principal activities of the planning process was a survey of the condition of the NLM collection.

The NLM collection today stands at 3.3 million items in a variety of formats including books, journals, audiovisual materials, microfilm, manuscripts and prints and photographs. An annual literature budget of about $2.2 million supports the acquisition of approximately 16,000 books, 1,000 audiovisuals, 23,000 serial titles, 33,000 manuscript items, and 450 prints and photographs each year. The Library collects materials comprehensively in all major areas of the health sciences and to a lesser degree in related areas such as chemistry, physics, botany and zoology. (For a discussion of the historical development of the NLM collection see Appendix 1, p. 7.)

Survey Methodology

As a first step to sampling the condition of the collection, the following discrete groups of material were identified:

- Printed materials published prior to 1801 (40,000 volumes)
- Monographs published between 1801 and 1870 (40,000 vols.)

- Monographs published from 1871 to date (465,000 vols.)
- Serials published from 1801 to 1870 (20,000 vols.)
- Serials published from 1871 to 1969 and located on the B-3 stack level (371,000 vols.)
- Serials published from 1969 to date and located on the B-1 stack level (278,000 vols.)
- Serials published from 1871 to date and located on the B-2 stack level (91,000 vols.)
- Pamphlets located in HMD and on the B-2 stack level (172,000 in 7,249 boxes or bound volumes)
- Theses located in HMD (282,000 in 6,408 boxes or bound volumes)
- Modern unbound manuscripts (1,206,000 items in 2,700 boxes)
- Bound manuscripts (1,000 vols.)
- Videocassettes (5,900)
- Audiocassettes (9,000)
- 16mm Films (2,300)
- Filmstrips (844)
- Slides (230,000 in 3,000 carousels)
- Historical Film Collection (2,000 reels)
- Fine prints and photographs (75,000)
- Microfilm (34,000 reels)
- Microfiche (122,000 items)

The decision was made not to survey the condition of the following parts of the collection for the reasons described below:

- Printed materials published prior to 1801 (40,000 volumes).
- Bound manuscripts (1,000 volumes).
- Historical Film Collection (2,000 reels).

These collections have already been examined comprehensively, and programs are underway to preserve them. In general, the

condition of the pre-1801 printed collection is good. Many bound manuscripts require rebinding, and this process is underway. Most items in the historical film collection must be transferred to new film stock in order to preserve them.

- Fine Prints and Photographs (75,000 items)
- Microfilm (34,000 reels)
- Microfiche (122,000 items)

There is insufficient in-house expertise to assess the deterioration of these three groups of material. Library Operations is taking steps to have these collections assessed by outside experts.

All other elements of the collection were sampled during the course of this preservation study.

Sample Selection

After consulting several standard sources on statistics and sampling, the Task Force on the Physical Condition of the Collection decided to use the procedures described by M. Drott (1). As high a level of confidence and as small a range of tolerance as possible were desired, given the available resources and established time frame. Taking all factors into consideration, it was agreed that a level of confidence of 95% with a tolerance of ± 5% would be both acceptable and manageable. This resulted in sample sizes of up to 384 items in each discrete collection.

For paper-based materials, neither the automated bibliographic files nor the manual shelf list of the NLM collection provide comprehensive coverage at the item level, so that every physical piece in each discrete location could be represented. Since each piece had to have an equal chance of being selected in the samples and the bibliographic files could not assure this, sampling of the paper-based materials was done directly from the shelves.

The paper-based collection is housed on ranges, or rows of stacks. Each range is comprised of from eight to twelve three-foot sections; and each section is comprised of six to seven shelves. Each of the ranges in all of the collections to be sampled was given a unique number. These numbers were later correlated to a simple list of sequential numbers to facilitate look-up in a random number table.

Selection of each sampled piece in each discrete collection followed a strict four-step process as follows:

From a table of random numbers, select:

1. Number corresponding to range number

2. Number corresponding to a section within the range

3. Number corresponding to a shelf within the section

4. Number corresponding to the book count from left to right on the shelf

To speed the process and to eliminate reference to random number tables while actually in the stacks, work sheets were made up in advance so that staff collecting the sample could put their worksheets in range order and move through the collections in one sweep.

For most of the audiovisual media, listings from AVLINE by media type could be used, rather than direct shelf sampling, since each physical audiovisual piece had an equal opportunity of being selected from the listings. Random number tables were used to select the samples from the listings. Audiocassettes were sampled by a method similar to that used for print materials, with cabinets and drawers substituting for ranges and shelves, in the selection of the sample.

Information Collected

For each item sampled, the call number (including volume number and year) and a short title were recorded. For paper-based materials, two major aspects of physical condition were recorded:

(1) Overall condition of the binding and text block integrity

This was done by inspecting the sampled item for any of a standard list of signs of physical deterioration (e.g., broken bindings) or environmental damage (e.g., mold, water damage) and assigning it to a general category of physical condition based on the presence or absence of these signs. (A description of the signs and categories appears in Appendix 3.)

(2) Extent of brittleness of paper

This was determined by performing the "fold test" on a corner of a middle page of the sampled item and recording the number of double folds made before the corner broke off. The fold test is the standard method of determining brittleness. (A complete description of the technique is included in Appendix 3.)

No chemical analysis was conducted on the samples. While desirable, collection of data reflecting paper acidity (as measured by pH) and lignin content are of secondary importance because it can be assumed that the vast majority of the collection contains paper with high-acid content. Staff performing the physical inspection and fold test on sampled materials received special training to ensure a uniform approach to the sampling.

Sample audiovisual media were checked for general physical condition, visual quality, and/or audio quality using standard criteria for deterioration of such media and assigning condition categories. Condition criteria include number of splices for films, quality of the color of images presented (i.e., good, off-color, faded), etc. Physical condition was determined by visual inspection of the media. Video and/or audio quality were determined by viewing or playing portions of the sampled programs on appropriate audiovisual equipment. In addition, videocassettes were evaluated using a microcomputer-based video tape evaluator/cleaning machine which can detect video and audio tape dropouts.

Results of the Survey

Table 1 summarizes the physical condition of the binding of all print materials. No environmental damage was found in any of the sampled items in these categories.

Table 1

Physical Condition of Binding and Text Block (%)

		Estimated Total Volumes	% of Sample With Damaged Binding	Estimated Total Vols. With Damaged Binding	% of Sample With Torn Pages	Estimated Total Vols. With Torn Pages
1800-1870	Monographs	40,000	26.3	10,500	5.7	2,300
1871-	Monographs	465,000	2.9	13,500	1.7	7,900
1800-1870	HMD Serials	20,000	18.0	3,600	6.0	1,200
1871-1969	Serials (B3)	371,000	11.3	41,900	6.9	25,600
1970-	Serials (B1)	278,000	0	0	0.5	1,400
1871-	Serials (B2)	91,000	3.6	3,300	0.1	100
Pamphlets		7,200	14.2	1,000	1.2	100
Theses in HMD		6,400	6.2	400	2.9	200
Total		1,278,600	5.8	74,200	3	38,800

Bindings of monographs and serial volumes published between 1801 and 1870 show the highest rate of damage. In absolute numbers, the 1871-1969 serials include the majority of the damaged volumes.

Not surprisingly, the bindings of the serial collection on the B-1 level, which includes only the latest 15 years of publication, were found to be in excellent condition. The low incidence of damage (.5%) in this group of materials appears to indicate that the heavy use of photocopiers on the B-1 collection during the last five years has not had a significant negative effect on bindings.

Table 2 shows the physical condition of the unbound manuscript collection.

Table 2

Physical Condition of Modern Unbound Manuscripts

Condition	% in This Condition	Estimated Total Number of Boxes in This Condition
Good	45	1,220
Fair (Container damage and/or manuscripts have frayed edges or tears or presence of rusting metal clips, staples, etc.)	32	860
Poor (Frayed edges and rusting metal clips, etc., and/or manuscripts badly yellowed or damaged from insects, water, or mold, etc.)	23	620
TOTAL	100	2,700

A large number of the unbound modern manuscripts are in poor condition (wrinkled, torn, etc.) due to the way they were stored prior to their acquisition by NLM. Over 20 percent show some evidence of damage caused by mold. Again this appears to have occurred before NLM acquired the

manuscripts because no mold damage was found in any other elements of the collection.

Table 3 summarizes the brittleness of all surveyed paper-based collections. In this table, "brittle" paper is defined as paper which broke off after two or fewer double folds in the fold test. This definition has been used by other research libraries which have conducted similar studies (2).

Table 3

Summary of Brittleness of NLM Paper-Based Collections

	% of Sample Brittle (2 folds or less)	Estimated Total Vols.	Estimated Total Vols. Brittle	Estimated Brittle Vols. Already Microfilmed
1800-1870 Monographs	12.1	40,000	4,800	500
1871-to date Monographs	11.7	465,000	54,400	1,100
1801-1870 Serials	20	20,000	4,000	900
1871-1969 Serials (B-3)	11.2	371,000	41,600	9,100
1970-to date Serials (B-1)	0	278,000	0	
1871 to date Serials (B-2)	5.5	91,000	5,000	
Pamphlets	15.5	7,200*	1,100	
Theses	33.5	6,400*	2,100	
Manuscripts	4.2	2,700**	100	
Total	8.8	1,281,300	113,100	11,600

* volumes or boxes

** boxes

Embrittlement, though serious, is not as widespread as was feared. From 1801 to date there are 1.28 million volumes of monographs, serials, pamphlets and theses in the NLM collection. Accounting for the proportional differences in the sizes of the various collections, the sampling indicates that there are approximately 113,000 brittle volumes, or 8.8%. The amount of brittle paper in other major collections far exceeds that found in the NLM collection. In a recent evaluation of the Yale print collections (2), 29% of the volumes sampled were found to be brittle, using the same criterion (2 or fewer double folds) applied in NLM's survey. LC estimates that 25% of its law and general collections is brittle, based on one or fewer folds in a fold test done by machine (3). It is not known how many manual folds are equivalent to one machine fold.

Table 4 summarizes the condition of the audiovisual collections that were surveyed. The term "off-color" refers to unrealistic fleshtones and colors of known objects; "faded" denotes that all objects are the same color.

Table 4

Medium	Physical Condition	Visual Quality	Audio Quality
Videocassettes (1960 - date)	100% good to excellent	some visual and audio dropouts but none affected quality of picture or sound.	
Audiocassettes (1970 - date)	99.7% excellent	--	98% good
16mm Films (1947 - date)	65% good	87% good	100% good
	30% fair	10% off-color	
		2% faded	
Film Strips (1968 - date)	98% good	87% good	--
		12% faded	
Slides (1950 - date)	97% good	95% good	--
		3% off-color	
		2% faded	

The audiovisual collections are generally in good condition. The principal exception is the 16mm film collection; over 35% of the films sampled had 4 or more splices. In addition, 12% of both the 16mm films and the film strips have suffered some loss of color.

Summary

The condition of the NLM collection is better than had been anticipated. With 8.8% or an estimated 113,000 volumes of its paper-based collections embrittled, NLM faces a smaller preservation problem than other research libraries, which have significantly larger collections of old material and percentages of brittle paper that exceed 25%. In general, NLM's audiovisual programs are also in good condition. By taking action immediately, NLM can ensure preservation of the content of the endangered volumes and also extend the life of the remainder of the collection. Delays may lead to the loss of already brittle materials and the increase in the number of brittle items requiring very expensive preservation techniques.

IV. PHYSICAL FACILITIES AND ENVIRONMENT

The physical facility and environmental conditions in which library materials are stored have a profound effect on the preservation of those materials. There are five environmental factors which affect the longevity of paper:

1. Temperature and Relative Humidity
2. Atmospheric Pollutants
3. Light
4. Mold
5. Insects and Rodents

Studies indicate that the lower the storage temperatures for printed materials, the longer they last. For every 9°F decrease, the useful life of the paper is approximately doubled. In areas where books and journals must coexist with humans, a temperature of 65°F is often recommended. A proper humidity level is also important. Excessive humidity promotes acid hydrolysis and biological attack by mold and bacteria, while lack of sufficient humidity promotes desiccation and possible loss of strength. Relative humidity levels of 45 (±5) percent are recommended for paper-based materials. Films and videocassettes benefit from cooler and drier storage conditions. A temperature of 50°F or less and relative humidity between 25-30 percent is recommended for such materials. Both temperature and humidity levels should be kept as constant as possible, to avoid the weakening of library materials which can result from cyclical variations in the climate in which materials are stored. Any changes should be infrequent, gradual, and less than 10°F in storage temperature and 10 percent in relative humidity.

Atmospheric pollutants such as sulfur dioxide, oxides of nitrogen, and ozone have been identified as harmful to paper. Compounds containing oxides of sulfur can combine with moisture to form sulfuric acid. Nitrogen dioxide and ozone are oxidants and thus accelerate oxidative degradation. Dirt and dust act as abrasives, and can actually imbed into the surface of paper. Additionally, such particulates can carry adsorbed sulfur dioxide and nitrogen oxides.

Light, both in the ultraviolet and visible frequencies, increases the rate of chemical reactions within paper. Some of the effects of light exposure are apparent, such as bleaching of colors and certain inks, and the darkening of paper to yellowish or brownish color due to a reaction of any lignins present with other chemical compounds. Unseen effects include oxidation, and the eventual breakdown of the cellulose chains in the paper's fibers.

While temperature, relative humidity, atmospheric pollutants, and light are considered to be the four primary environmental conditions affecting preservation, damage from mold or mildew and insects and rodents must also be avoided. Mold or mildew growth causes staining, loss of paper strength, and eventually the deterioration of the material itself as it is consumed by these biologic agents. Mold spores are found in the air and on books, and grow rapidly in stagnant air with a temperature of 80°F or above and a relative humidity in excess of 65 percent. Because paper is composed of a variety of organic substances, insects and rodents will feed upon it if other food sources are not available.

NLM's Physical Facility

From 1836 to 1962, the NLM collection was housed in a series of facilities, none of which provided a particularly good environment for the Library's materials. The major exception to this rule was the storage provided to the Library's pre-19th century books from 1942 to 1962 at the Allen Memorial Library Building of the Cleveland Medical Library Association. (For a description of the early facilities of the Library, see pp. 8-9 in Appendix 1).

The completion of the present Library building on the NIH grounds in 1962 provided the Library with greatly improved physical facilities. The five-story Bethesda building, measuring 276 feet by 192 feet and containing 231,560 square feet, is steel with exterior walls of limestone, granite and marble trim. Three floors of the structure are below ground, a precaution against the possible atom bomb attack envisioned by civil defense planners of the 1950's. This defensive planning led to the insertion of narrow, recessed windows on the main (first) floor and mezzanine. The top floor, the mezzanine, contains administrative offices; the first floor holds the main reading room, catalog area, history of medicine reading room and offices, and staff offices of members of the Technical and Reference Services Divisions. The bottom three levels, under ground, contain stack areas as well as work areas for staff of the Reference Services Division, Technical Services Division, History of Medicine Division, Bibliographic Services Division, MeSH Section, and RML Office.

At the current rate of acquisition of new materials, it is estimated that adequate space for the collection will exist for approximately twenty years. This time could be extended substantially by the installation of compact shelving on the B2 Level. To date the Library has received conflicting opinions as to whether the B2 floor is sufficiently strong to support compact shelving. Acquisition of an increasing number of materials in non-print formats and disposal of some printed materials after preservation copies are made will obviously affect NLM's space requirements for the collection.

The entire Library building is served by a single heating/ventilating/air conditioning (HVAC) system. Steam and chilled water are produced at a central NIH facility, and piped into the building. Eight air-mixing units serve different areas of the building. Air is drawn into the building from ground level vents located on the west side. Although it is an advantage that the building contains no furnace to generate internal pollutants, the location of the intake vents is often downwind from the central NIH power plant, found to the northwest. The existing HVAC system does not contain chemical filters. Mechanical filtration for dust and other particulate matter is accomplished in two stages through a bank of screen-type fiberglass filters, and then through fiberglass bag filters rated at 90% efficiency. Humidity can be both instilled into and removed from the air by the HVAC system, which is monitored and maintained by the building engineer, assigned by the NIH Division of Engineering Services.

Most of the lights in the building are fluorescent tubes. For the past several years, the majority of lights in the areas where materials are shelved have been covered with sleeves that block the emission of ultra-violet light.

The building is protected against fire by a water sprinkler system. The rare book collections (incunabula room and B1 stacks in HMD) are protected by a carbon dioxide fire extinguisher system. The Library has in the past considered replacing carbon dioxide with halon, which might present a lesser threat to the safety of employees, but no action has been taken in this direction. In accordance with the federal policy of "self-insured" protection, neither NLM nor its collections carry special insurance against damage or loss.

Facilities for exhibiting portions of the collections, which is done on a regular basis and frequently involves rare books, are not ideal. The cases used have locks, but would be easy to open. The plastic tops do not filter out ultraviolet radiation from natural or artificial light.

The Library's security system includes electronic surveillance and a search of bags, briefcases, etc. by a guard as patrons and staff leave building 38. Large portions of the collection, including rare books and manuscripts, are not provided with security labels and would therefore be undetected by the electronic security system. Access to the historical collections is more restricted, however, than access to the general collections. There is no evidence that loss by theft has been great over the years, but the theft of an infrequently used item can go undetected for a long time.

Environmental Conditions at NLM

Since there was little available data on environmental conditions in the NLM building, a survey of these conditions was also an important part of the preservation planning process. The Task Force on Environmental conditions, assisted by staff from NIH and the National Bureau of Standards, collected a variety of data throughout the Library.

Survey Methodology

The areas examined were:

1. First Floor

    a. Main Reading Room
    b. History of Medicine Reading Room
    c. Prints and Photographs Collection
    d. Incunabula Room

2. B1 Level

    a. General Collection Stacks
    b. History of Medicine Collection stacks

3. B2 Level

    a. General Collection Stacks
    b. History of Medicine Collection Stacks
    c. Cold Storage Vault

For each of these areas, the following information was gathered:

1. Division and Section of the Library responsible for maintenance
2. Usage
3. Area in square feet
4. Ceiling description
5. Lighting method
6. Floor covering
7. Wall covering
8. Shelving type for materials housed
9. Fire protection
10. Miscellaneous pertinent facts

The Task Force identified six major environment-related parameters to examine: (1) temperature (2) humidity (3) light (4) atmospheric pollutants (5) cleanliness (6) shelving structures.

Temperature and relative humidity data were gathered using nine Honeywell recording hygrometers (Model 612X9). Each instrument was calibrated using a sling psychrometer. These nine units were located at representative sites--with electrical outlets available nearby as well--in the following areas:

1. Reading Room, first floor
2. General Collection stack area, B1 level
3. General Collection stack area, B2 level
4. General Collection stack area, B3 level
5. History of Medicine stack area, B1 level
6. History of Medicine stack area, B2 level
7. Incunabula Room first floor
8. Prints and Photographs Collection, first floor
9. Cold Storage Vault, B3 level

Recording began for most units on December 23, 1984, and has continued since that time. Data for each Sunday, Wednesday, and Friday, at 8:00 a.m., 1:00 p.m., and 5:00 p.m. were extracted from the recording charts of the hygrometers. It was determined that no acceptable source of previously gathered temperature and humidity data was available to compare with data from the present study. Ambient temperature and relative humidity readings, daily highs and lows at National Airport, were obtained from the U.S. Weather Bureau, and from the daily weather review in the Washington Post.

In general the temperature levels were found to be quite stable throughout the areas examined, within a range of 60°F to 73°F, which compares favorably to the frequently cited standard of 65°F ± 5°. One exception was the History of Medicine Prints and Photographs Collection room, which consistently was warmer, at approximately 74°.

In contrast to temperature conditions, relative humidity levels varied widely, from a low of 20% to a maximum of 45%. This range is well below the optimal level of 45-55%. Many of the lower readings occurred in the History of Medicine areas. In investigating this situation, the Task Force discovered that air mixing unit number seven, which serves that area, has no humidification capacity. All other mixing units have appropriate humidification equipment. Although not observed by Task Force members, it was noted by NLM staff that condensation tends to form above the cold storage vaults, especially during summer months.

Lighting conditions were assessed on the B1, B2, and B3 levels in the stack areas, and in the main reading room, at the same locations where the recording hygrometers were positioned. Lights are primarily fluorescent tube units, with conventional on-off switches mounted locally on the wall. Most lights in the stack areas are covered by ultra-violet blocking tubes. Light intensity measurements were taken by NIH Division of Safety staff using a Weston Foot-Candle Meter. Ultra-violet radiation levels were measured by members of the environmental conditions Task Force using a Crawford UV Monitor Type 760/L. The readings were made on a one-time basis--the artificial light sources for the underground levels remain constant, while the reading room varies somewhat based on external sun light levels.

Results of the lighting measurements indicated that the overall intensity and proportion of ultra-violet radiation were well within recommended levels. In the stack areas, the intensity levels ranged from 13-20 foot-candles (130-200 lux). In the reading room the measurement was 65 foot-candles. This latter level is above the recommended 30-50 foot-candle range, but was recorded on a bright sunny day. The ultra-violet radiation proportion was 25 uW/lumen throughout, compared to a maximum recommended level of 75 uW/lumen. UV readings taken directly beneath a bank of unsheathed fluorescent bulbs showed twice the level compared to sheathed bulbs, 50 uW/lumen. UV readings taken near windows in the reading room and lobby areas shows UV proportions of 60-75 uW/lumen but dropped off very rapidly as the instrument was moved toward the interior of the room. Measurements in the Learning Resources Center and some of the processing areas were very similar to those taken in other areas where the collection is stored.

Atmospheric pollutants including sulfur dioxide (SO_2), nitrogen dioxide (NO_2), hydrogen sulfide (H_2S) and ozone (O_3), were sampled by NIH Division of Safety staff using a Mine Safety Appliance (MSA) Universal Tester Pump with the appropriate MSA detector tubes. These tubes are certified for the following accuracy ranges by the National Institute for Occupational Safety and Health (NIOSH).

Sulfur dioxide: 2.5-25 parts per million (by volume)
Nitrogen dioxide: 2.5-25 PPM
Hydrogen sulfide: 5-50 PPM
Ozone: 0.5-4 PPM (not certified by NIOSH)

Samples were taken on the B1, B2, and B3 levels, and in the main reading room at the same locations where light intensity and temperature/humidity data were gathered. Given the sensitivity of the MSA tubes as described above, presence of the four specified atmospheric pollutants was not detected.

To determine the actual levels of concentration of atmospheric pollutants required more sensitive equipment. Experts from the National Bureau of Standards (NBS) were engaged to measure the baseline presence of sulfur dioxide, oxides of nitrogen, and ozone. At their recommendation, testing for hydrogen sulfide and hydrocarbons was not done, as it was not considered necessary. Highly sensitive instruments were brought into the building and calibrated. Readings were recorded between April 8 and April 15, 1985 in the B2 stacks, and in the main reading room on the B1 level. Ozone was also measured in the photocopy room on the B1 level.

Table 5 summarizes the environment-related quantitative data gathered and compares them to the recommended levels for the various parameters and atmospheric pollutants. (Appendix 3 is a copy of the full NBS air quality report.)

Table 5

Parameter	NLM Condition	Recommended Range	Source of Recommendation
Temperature	60°F - 73°F	65°F ± 5°F	a/
Relative Humidity	20% - 45%	45 - 55%	a/
Light Intensity	13-20 foot-candles (stacks)	maximum of 30-50 foot candles	a/
	65 foot candles (reading room)		
Ultra-violet proportion	25 uW/lumen	less than 75 uW/lumen	a/
Atmospheric Pollutants			
Sulfur dioxide	Avg. 6 ppb b/ Max. 49 ppb Min. 0 ppb	from 0 to 4 ppb	c/
Nitrogen oxides	Avg. 44 ppb Max. 208 ppb Min. 22 ppb	from 0 to 5 ppb	d/
Ozone e/	Avg. 4 ppb Max. 17 ppb Min. 1 ppb	from 0 to 13 ppb	f/

a/ Darling, Preservation Planning Program: An Assisted Self-Study Manual for Libraries (ARL, 1982) (4)

b/ Parts per billion (by mole).

c/ The British Museum (5,6,7) and the Royal Ontario Museum (8) recommend complete removal, while Banks (9) and Thomson (7) recommend 4 ppb. NBS Workshop on Environmental Conditions for Archival Storage recommended 2 ppb. (10)

d/ The British Museum (5,6,7) and the Royal Ontario Museum (8) recommend complete removal, while Thomson (7) recommends 5 ppb for nitrogen dioxide. The NBS Workshop (10) recommended 2.5 ppb for nitrogen dioxide.

e/ Ozone measurements summarized in this chart were taken in areas where the collection is stored. Ozone measurements were also taken in the photocopier room serving the reading room. The existing copiers clearly were a source of ozone; levels ranged from a minimum of 2 ppb during off-hours, to a maximum of 62 ppb during peak-usage hours. Average ozone level was 14 ppb.

f/ The British Museum (5,6,7) and the Royal Ontario Museum (8) recommend complete removal, while Thomson (7) recommends 1 ppb. The NBS Workshop (10) recommends 13 ppb.

Members of the Task Force on Environmental Conditions also conducted a walk-through of the spaces to assess cleanliness and shelving conditions. They found that housekeeping services were inadequate in the stack areas, as evidenced by levels of dust and dirt found on the floors and on shelving units. No testing for biologic agents such as mold or bacteria was conducted. Shelving units and bookends currently in use do not damage the collection. However, the number of book trucks and step stools available to transport and access materials is insufficient.

Smoking, drinking, eating and the cultivating of plants are common in many work areas throughout the Library and while these practices can be a potential hazard to library materials, no serious or widespread damage was discovered. Policies restricting these activities do exist for the stack areas, the public Reading Rooms, and HMD staff areas. Insects and rodents are not a problem in the Library.

Summary

Although there are some problems, in general the environmental conditions in the Library are good and probably can be improved without great expense. The construction of the Library, with relatively few windows and three floors below ground, makes it easier to maintain appropriate temperatures for the collection and to minimize the amount of ultra-violet radiation. Concern for the preservation of the collection is evident in the design of the building and in its heating and air-conditioning system.

The environmental survey has already prompted several specific actions to improve conditions for the collection. These include: a work order request to add humidification and dehumidification (if necessary) capacity to air-mixing unit number seven which, unlike all the other units, has never contained a humidifier; arrangements made by OAMS for housekeepers to dust the floors and stacks weekly and to wet mop monthly; a request to OAMS to install ultra-violet blocking tubes on all unshielded fluorescent bulbs in areas where the collection is stored or processed; a work request to the NIH Division of Engineering Services to install insulation above the cold storage vaults; and purchase of additional step stools and replacement book trucks.

V. COLLECTION USE AND MAINTENANCE

The amount and nature of physical processing, handling and use of Library materials by staff and patrons have an effect (either positive or negative) on the life of those materials. Some negative effects are chemical: for example, inks or adhesives used in marking may react with the materials. Most effects are physical, affecting the external structure of an item: bindings may be broken; paper and film torn; magnetic tape stretched, scratched, torn or erased. The susceptibility of materials to this kind of damage depends upon both internal and environmental factors. Paper embrittled through chemical reaction will disintegrate at a touch; a tight adhesive binding will split when opened under hot, dry conditions; a film subjected to extreme fluctuations in temperature or humidity will shrink.

The mission of any library is almost inevitably hostile to the preservation of its contents, for materials are acquired, organized and stored primarily to be used, and use necessarily takes a toll on condition. There will always be a tension and compromise between the need to preserve materials and to make them readily available to the Library's users.

Processing

Materials arrive at the National Library of Medicine from all over the world. Books and journals from some foreign countries arrive in poor physical condition due to the environmental or physical conditions under which they were transported, or the inferior quality materials of which they are made. Books received from the Library of Congress, 2%-10% of which are added to the NLM collection, are sent in canvas bags and bins and often show signs of damage. All materials receive a good deal of handling in processing. Items are checked in; subjected to the insertion of a wide variety of forms between their leaves; cataloged, and in some cases indexed, either inhouse or by contractors outside the Library; stamped; marked; labelled with security labels and machine readable identifiers; sent to be bound if necessary; and shelved. Some overcrowded processing areas and work stations increase the risk of damage to incoming materials.

Storage

Most of NLM's collections are housed in metal stacks. Journals from the period 1871-1969 are stored in compact shelving, and it is anticipated that over the next two years many more items will be transferred to existing or newly-installed compact shelving. Certain collections are stored under special conditions. Archival microfilm and the historical film collection are preserved in special cold storage vaults. Acid-free document boxes and folders are used to house the collections of papers

in the Modern Manuscripts collection. Fine art prints are stored flat in special cases. Overall, NLM's storage conditions are good.

Binding

Binding is a measure intended to protect library materials. Both binding preparation and the actual binding of NLM's post 1870 books and journals are done on contract. The preparation contractor collects loose journal issues and controls the shipment of those issues to and from the commercial binder. NLM currently is required to use a central binding contract for the Department of Health and Human Services that is administered by the Government Printing Office. The specifications for the binding are set and the contractor selected by GPO. Journals and soft-bound books are bound with a class A binding (standard library binding), and acid-free end papers are used.

Use

While most materials in the Library's collections are stored in a closed stack environment, the majority of them are accessible to patrons onsite in the public Reading Rooms and the Learning Resource Center or through NLM's interlibrary loan service. Onsite circulation includes provision of the original item to the patron, whether it be a journal issue, a book or an audiovisual, unless the original item is in very fragile condition. In FY 1984, over 191,000 items were provided to Reading Room and History of Medicine patrons. Items housed in the Reading Rooms are directly accessible by readers, with perhaps as many as 86,000 uses made each year, based on estimated reshelving counts. In addition to the normal wear and tear of handling by both staff and by patrons, heavy and unsupervised use is made of the self-service photocopy machines (1.1 million exposures were made by patrons in FY 1984), and audiovisual materials are used on LRC playback equipment, most of which is more than 10 years old. Both types of use are known to shorten the life expectancy of the materials.

The majority of interlibrary loan requests are for current journal articles and are filled by sending out staff produced photocopies. Nearly 103,000 articles were photocopied in FY 1984. Books and audiovisuals from the general collection are regularly sent out on interlibrary loan to requestors. These original loans numbered 10,700 in FY 1984. The History of Medicine Division also sent out some original items on loan, but most of the 2000 requests in FY 1984 were filled as photocopies or on microfilm. In the latter case, a microfilm master is retained for future NLM use.

Added to the actual patron use of library materials is the staff handling which goes into providing items to a patron, and the necessary reshelving of items following use. Conservatively, the total handling count for fulfilling NLM's service mission could be over 1 million uses

annually, concentrated on a relatively small portion of the entire NLM collection.

Education

Staff and user handling techniques are influenced by the presence or lack of instruction and policies. Instruction and monitoring of all processing and service within Library Operations focuses on intellectual and not physical handling, with few written guidelines for the latter. No instruction for NLM patrons (either onsite or remote) is currently conducted.

Summary

The results of the survey of the physical condition of items in the NLM collection indicate that current processing and use practices are not having a serious negative effect on the Library's materials. This does not mean, however, that there is no room for improvement in the way NLM's collection is handled by staff and users. The process of observing, documenting and discussing the use and processing practices that can affect the Library's collections has already caused staff members to be more preservation conscious and alert to potentially damaging handling policies and techniques. Some physical damage is unavoidable in a service organization where use is expected and encouraged, but steps can be taken to reduce even further damage during processing and after the materials are in the users' hands.

As a result of this study several steps have been initiated or are planned to reduce unnecessary wear and tear on library materials. These include: reviewing the number and type of preliminary forms that are inserted in library materials as they are processed; assuring that all labels and markers used are as benign as possible; ceasing the use of metal paper clips to mark pages; redesigning the Reader Service sorting area to be more efficient and reduce jumbles of materials; purchasing dust covers for all audiovisual and microfilm equipment and developing a plan for routine preventive maintenance as well as phased replacement of such equipment; and ensuring that the serial issue in the best physical condition is bound, when more than one copy is available on the shelf.

VI. PRESENT LEVEL OF PRESERVATION ACTIVITY AT NLM

NLM's current preservation activity consists primarily of binding serial issues and paperbound monographs, collection maintenance, and special preservation of rare books and archival films. From 1966 to 1982, with a combination of in-house staff and contract support, the Library microfilmed runs of about 2,000 early Index Medicus serial titles and 3,000 - 4,000 monographs, principally from the period 1871 to 1906. This program was suspended because of the high cost of microfilming, the promise of new preservation technologies and the lack of a plan for assigning preservation priority to the remaining items in the collection. At present, only about 172,000 pages are microfilmed in-house each year. The majority of these are filmed to fill interlibrary loan requests for materials in the historical collections which cannot be loaned in the original.

The Library first developed a Disaster Recovery Plan and assembled special supplies and procedures for handling disasters affecting the collection in 1979. The plan has been revised periodically, most recently in conjunction with the development of this Preservation Plan.

Responsibility for current preservation activities is divided among the Reference Services Division (RSD) and the History of Medicine Division (HMD). The following chart summarizes staff and other resources devoted to ongoing preservation activities in FY 1985. The figures exclude: (1) administrative overhead in the offices of the Chiefs, RSD and HMD, and the Associate Director for Library Operations; (2) the NLM staff time devoted to the preparation of the Preservation Plan; (3) a proportional share of the NIH Management Fund; and (4) Office of Computer and Communications Systems expenditures that can reasonably be assigned to automated support of current collection maintenance, binding, and microfilming activities.

Table 6

NLM Resources Allocated for Preservation - FY 1985

Staff Support

	NLM FTE	Budget
Reference Services Division		
Circulation and Control Section	7.25	138,100
Audiovisual Resources Section	1.5	28,400
History of Medicine Division	2.4	51,700
Total	11.1	218,200

Other Expenditures

Binding Preparation Contract	253,500
GPO Binding Contract	184,000
Compact Shelving purchase	55,300
Preservation of archival films	135,000
Rare book binding	40,200
Manuscript rebinding	60,000
Consultants - preservation plan, air quality sampling, evaluation of prints and photographs collection	11,500
Other miscellaneous - equipment, equipment maintenance, supplies, etc.	32,600
Total	772,100
Grand Total	990,300

VII. CURRENT STATE OF PRESERVATION TECHNOLOGY

In the broadest sense, any activity that extends the life of library materials is a preservation technique. This is why the enhancement of the environment in which materials are stored and improvements in the way materials are handled are important to any preservation program. Using a narrower interpretation, however, a preservation technique is something that improves the intrinsic durability of an item or creates a copy of it in a more durable medium. Relatively few such techniques exist, particularly for mass preservation of the post-1850 printed materials which are most at risk. Fortunately, recent expansion of interest in preservation among research libraries has sparked research in mass preservation techniques. Although currently available options are still very limited in number, there is promise of better things to come.

A description of the major techniques that are currently available or are the subject of research activity follows, with an estimate of their costs, if reasonable estimates are possible.

a) Mass Deacidification

Manual deacidification methods, involving immersing the pages of a disbound book or the brushing/or spraying of each page with a deacidification agent, have been in use for some time by paper conservators. These traditional single-sheet methods are too slow and expensive for NLM to apply on a large scale, although they continue to be appropriate for rare books, manuscripts and art prints. Newer mass deacidification procedures promise a more affordable means of extending the life span of paper-based materials by as much as four to five times the life of the paper before it was treated. This could be two to three hundred years for some materials. The newer the materials are at the time they are deacidified, the more they can benefit from the process.

There are two mass deacidification procedures which have received extensive testing, the Wei T'o liquefied gas mass deacidification process in use at the Public Archives of Canada and the diethyl zinc gas deacidification (DEZ) process of the Library of Congress. At the moment, the facility at the Public Archives of Canada is the only mass deacidification center in operation. Since 1981, six million pages from the Public Archives and from the National Library of Canada have been deacidified at this facility, using the Wei T'o method. The estimated cost of building a Wei T'o facility is at least $500,000 and would be considerably higher for the capacity needed by NLM. The U.S. Congress has appropriated $11.5 million for the construction of a DEZ facility at Frederick, Maryland for the Library of Congress. Scheduled for completion in 1987, this facility should have an annual capacity of 500,000 to 1,000,000 volumes.

The estimated cost of actual deacidification of a book by either the DEZ or Wei T'o method, which is now about $3.50 per volume, is expected to drop to $2.25 or less per volume in a fully operational, efficient plant. Preparation and transport of materials to and from a locally available facility will cost an additional $2.00 per volume, for a total of $4.25 per volume. NLM's cost per volume will be higher if the Library is required to pay for all or part of the cost of the construction of a mass deacidification facility.

The relatively low cost of mass deacidification, as compared to the cost of mass disk storage or microfilm, makes it an attractive preservation technology. Deacidification has the advantage of preserving materials in their original format, if that is important. It is also not subject to any copyright restrictions. Deacidification is of no use, however, for that portion of the collection which is already embrittled, as it can only halt and not reverse the process of acid deterioration of paper. It also offers no solution to storage space or remote access problems. In any case, mass deacidification will not be available to NLM before 1988 or 1989. That is probably the earliest date that NLM could arrange to begin using a portion of the LC DEZ facility, or to obtain deacidification services from other sources.

(b) Strengthening of Paper

There are several experimental processes designed to strengthen paper. One method deposits a strengthening agent in a vacuum at room temperature without catalysts. Another uses an acrylic copolymer and initiates polymerization with a radioactive source. This technology is not available to NLM for current use, even for individual rare items, and, in its present forms, would cost $50-$75 per volume. The level of research interest in this technique is increasing, however, and it may become viable and cost-effective for mass preservation in the future. The Department of the Treasury is interested in applying one of the strengthening processes to the one dollar bill, and LC's Preservation Office also intends to look at this technology.

(c) Mass Disk Storage

Mass disk storage involves electro-optically scanning original materials and storing the images on another medium and is therefore suitable for preservation of materials that are already brittle. The electronic storage of information in digital form on optical digital disks appears to have great promise for preservation. The advantages of the disk medium include high storage density, rapid random accessibility, and compactness. The major attributes of image signals in digital form are: the ability to regenerate, compress, or enhance the images stored and to convert bit-mapped imagery into machine-readable text. There is no generation loss in the transfer of the signal from one disk to another, as occurs in copying microfilm. The method offers exciting

opportunities for linking bibliographic information (such as a MEDLINE or CATLINE citation) to the automatic retrieval and display of document images. The Lister Hill Center has demonstrated such a link-up of citations retrieved from NLM's mainframe computer and electronic document images stored on magnetic disk. Mass disk storage has the potential to play an important role in preservation in the next several years, especially for frequently used materials that would benefit most from increased ease of access and for materials originally published in machine readable form.

Although both LC and NLM have developed prototype systems to support research in the use of disk technology for information storage, access and preservation, the preservation potential of the disk medium is not yet clearly understood. Before an operational disk preservation system can be put in place, additional research is necessary to answer several basic questions about the technology, including the effective life expectancy of the disk (current estimates are 10 to 30 years), the most effective compression techniques, and the methods for monitoring image quality in a production environment. The answers to these and other questions will have a significant effect on the cost of preservation on disk. Since most commercial interest in disk technology relates to its erasability and reusability, NLM and LC may not be able to rely on the private sector to fund research into the preservation properties of the medium. It is unlikely that NLM will be able to use optical disks for large scale preservation in the next two to three years, given the present uncertainty about the preservation characteristics of the medium and the total system cost of a disk operation.

The general use of disks for preservation, at least for post-1906 materials, depends not only on technological advances, but also on the resolution of complex questions about intellectual property rights. Because it permits multiple and remote use of single copies of works, disk technology is perceived as a greater threat to the rights of copyright owners than preservation on microfilm.

(d) Microfilming

Microfilm, like mass disk storage, is a suitable preservation medium for printed materials that need not be preserved in their original format or have deteriorated to the point where preservation in the original format is not currently possible. When processed properly and stored under "archival" conditions, silver halide film is expected to last indefinitely. Proper storage requires special conditions (e.g., low temperature). Microfilm, like disk, offers the advantage of compactness. Unlike disk, it is not easy to access and use. Microfilmed images may be transferred to disk effectively, although the production costs of high volume transfer are not yet known.

The cost of microfilming an average volume is $40.00-$50.00, including $0.15 per exposure (for two printed pages) for the original master, $3.50-$4.50 for the service master and the diazo service copy, and $9.00 for preparation costs and recording preservation data. The price per volume is therefore at least several times the cost of deacidification. Although it is not yet possible to estimate the production cost of preservation of print materials on disk, that cost is unlikely to be significantly lower than the cost of microfilming. Preparing documents and capturing images, which are the major cost factors in microfilming, are also likely to be the major cost factors for disk preservation, given the same decision regarding the retention or destruction of the original being copied.

Although the ease of accessing materials on disk and the possibility of tying access to bibliographic information suggests that optical disk technology may eventually surpass microfilm as a preservation medium, microfilm will probably continue to play a significant role in preservation for some time to come. Microfilming is in fact the only method now available to NLM for large-scale preservation of paper-based materials. Even in the future microfilm may continue to be an acceptable preservation medium for infrequently used material.

(e) Film to Film Transfer

At present the preferred method for preserving films is film to film transfer with no reduction in gauge (i.e., 35 mm to 35 mm; 16 mm to 16 mm). Black and white archival triacetate film has an estimated longevity of 300 years when stored under archival conditions. Color film is more difficult to protect, but an "archival" color film on triacetate with an estimated longevity of 100 years is being used to copy films. Films should be copied to an internegative film master, with the internegative then used to make an answer print or service copy. The internegative master can then be used to produce another answer print when the service copy is worn, thus prolonging the life of the original. The cost per film for this procedure averages from $500 to $600. The original masters require storage in a climate controlled vault. To make NLM's historical films accessible to more users, it may also be advisable to make video viewing copies for films of particular interest for research or teaching.

(f) Preservation Methods for Special Collections

Special collections are defined as pre-1801 printed literature (and any later printed works which are considered to be rare or of exceptional historical significance), manuscripts, and prints and photographs. These collections contain the bulk of the items in the NLM collection that must be preserved in their original format and also the majority of items that require special individual handling during preservation. Preservation techniques for these materials include: oiling of leather

bindings; hand rebinding and repair; individual deacidification; placement of materials in acid free folders and boxes, reconstruction of pages, encapsulation, etc. Any of the mass techniques described for post-1801 materials may also be appropriate for some materials in these collections, although greater care may be necessary to prepare the materials for preservation. Costs vary greatly depending on the condition of the original items and the specific technique chosen. The techniques are generally labor intensive and therefore expensive.

(g) Acquisition of Materials in Archival Formats

Although not strictly a preservation technique, the acquisition of new library materials made from substances with archival properties can be a cost-effective way of ensuring preservation of parts of a library's collection. Until recently, acquisition of materials in microform was the only choice available. With the development of a standard for "acid-free" paper and increased publication in machine-readable form, libraries may have increased opportunity to buy materials in archival formats—or at least in formats that are more easily and cheaply preserved.

Summary

When it becomes available, mass deacidification will probably be the cheapest alternative for preservation of paper-based material at an estimated cost of $4.25 per volume, ($2.25 for deacidification and $2.00 for preparation and transport.) The charge will be higher if all or part of the cost of constructing a deacidification facility is borne by the Library. Deacidification offers no space savings, but preserves the original artifact. With some effort, NLM should be able to obtain appropriate deacidification facilities by 1988 or 1989. Procedures for strengthening of paper are still in a very experimental stage, but could become practical in the future.

Mass disk storage has exceptional use characteristics, including random access, simultaneous use by multiple users, and the ability to link directly to automated bibliographic records. Because of these use characteristics, disk storage is more problematic than other techniques in regard to intellectual property rights. The preservation characteristics of disks are not fully understood and require further research. The results of such research are needed before accurate total cost estimates for preservation on disk can be developed.

Of the preservation techniques suitable for the mass of NLM's paper-based collections, only microfilming, at an average cost of $40-$50 per volume, is available to NLM today. Microfilm is very space-efficient if the original is not retained after filming, but it is also unwieldy to use.

There are generally accepted "best" methods for preserving segments of the audiovisual collections and the special collections (i.e., rare books, print and photographs, modern manuscripts). Because these methods involve skilled labor, they tend to be expensive--from fifty to several hundred dollars per volume or program.

In the future, acquisition of new materials in archival formats may reduce the required level of preservation activity and expenditure.

VIII. OTHER EXTERNAL FACTORS AFFECTING NLM'S PRESERVATION PROGRAM

NLM's preservation program must take into account a number of external factors affecting the U. S. information and biomedical communities, in addition to the current state of preservation technology. These include publishing trends, developments in the concept of intellectual property rights, changes in the ways health professionals acquire and use information, and the emergence of preservation as a critical concern in research libraries, which in turn has led to increased emphasis on cooperative library activities and the recent developments in preservation technology already described.

PUBLISHING TRENDS

Publishers are the primary source of NLM's raw materials--the books, periodicals, audiovisuals, prints and other library materials that make up the Library's collection. The worldwide publication industry determines the scope of the preservation problem that NLM will face.

For over a 100 years the trend has been toward lower cost, higher speed production of an ever increasing flood of publications, which, because of the acid paper, adhesives and binding techniques used in their manufacture, are subject to rapid deterioration. As the library community has become more aware of the inherent weakness of the materials it collects, it has attempted to persuade publishers to shift to methods that will ensure more durable products. Partially as a result, the National Information Standards Organization (NISO) has published a standard for permanent durable paper with an alkaline reserve. The availability of this standard could stimulate more acid-free paper production and provide a basis for influencing publishers to use it.

The definition of a "publication" has changed with the emergence of new media. An increasing amount of material is published in microform, especially computer-output-microfiche (COM); however, this medium too is subject to gradual destruction. Audiovisuals and electronically-based forms of information are proliferating daily and will present the Library not only with bibliographic, acquisition and service problems, but also with a different set of preservation problems.

INTELLECTUAL PROPERTY

Related to publishing trends are a spectrum of issues concerned with intellectual property rights. The question of who shall be reimbursed for what kinds of use of what kinds of "publications" is under continuing review as information becomes an increasingly valuable commodity. This in turn could affect the form and conditions under which publications may be reproduced for preservation

purposes.

Although the matter has not been tested in the courts, informed legal opinion holds that copying deteriorating print materials on microfilm in order to preserve their content in a library or archives can be considered a "fair use" of copyrighted works if there is no financial gain associated with the copying. The argument is particularly strong for NLM as a national library with statutory responsibility to preserve the biomedical literature.

Since material preserved on disk is available for simultaneous use and can be redisseminated much more easily than material on microfilm, the use of disk technology for preservation adds dimensions to the discussion about intellectual property rights. On the other hand, electronic technology also offers a far more reliable and consistent way of collecting statistics on use. This could make the property rights issue easier to resolve, since actual use may be monitored automatically.

CHANGES IN THE WAY HEALTH PROFESSIONALS ACQUIRE AND USE INFORMATION

Health professionals traditionally have demanded rapid access to information. Health sciences librarians traditionally have responded by providing the best or developing the newest in information services. In the last ten years microcomputer technology and the proliferation of online databases have profoundly affected the way health professionals acquire and use information. Artificial intelligence systems, electronic publishing, and developing "electronic colleges" have the potential for making even more significant changes. If current trends in hospital economics continue, there will be fewer libraries available close at hand to fill immediate needs. It is likely that there will be increasing numbers of technologically sophisticated physicians tapping into remote information resources both for current and older materials. The challenge to NLM then is not just to preserve the biomedical literature, but to preserve and store it in ways which will facilitate access for the user community and be appropriate to their changing needs.

EMERGENCE OF PRESERVATION AS A CRITICAL CONCERN IN RESEARCH LIBRARIES

Over the last 25 years the Council of Library Resources (CLR) has acted as a catalyst to focus attention on preservation as a critical concern. In large measure as a result of CLR's efforts, significant progress has occurred in several areas. There is a developing consensus on the size of the preservation problem which libraries collectively face, a recognition of the cost of confronting it and of the cost of failing to confront it. There is also a significant research effort which addresses methods to prevent or retard deterioration of library materials and methods for mass storage of copies of already deteriorated materials.

Preservation has emerged as a specialty within the library profession. Interest and expertise has spread beyond the circle of archivists and rare book librarians. The pool of trained and partially trained preservationists is expanding as is the demand for this type of expertise.

Funding of preservation projects by CLR, the National Endowment for the Humanities, and charitable foundations is increasing. Library organizations such as the Association for Research Libraries and the Research Libraries Group are taking advantage of available funding to stimulate preservation planning among research libraries and to develop cooperative preservation programs, including regional preservation centers.

The Library of Congress has established a National Preservation Program Office to provide information, educational support, and coordination among the many institutions engaged in preservation activities around the country.

Clearly the climate is favorable for NLM to expand its own preservation program and to work with other institutions to develop useful cooperative preservation projects.

IX. RECOMMENDED STRATEGIES FOR PRESERVATION AT NLM

An examination of the current condition of the NLM collection, the environment in which it is stored, the way its materials are processed and used, and the present level of preservation activity has revealed a preservation problem that can be solved if NLM takes immediate action to establish a comprehensive preservation program. In many respects, NLM is in a much better position than other U.S. research libraries which have such huge numbers of brittle materials that there is almost no possibility of saving them at all. Due to the relatively good condition of the NLM collection and its manageable size, NLM has the opportunity to fulfill its mandate to preserve the biomedical literature.

After careful evaluation of available options, the Preservation Planning Team recommends that NLM take the following actions to create a preservation program capable of ensuring the long-term availability of the scholarly record for biomedicine.

A. MODIFY THE NLM BOARD OF REGENTS' POLICY ON PRESERVATION

The NLM Board of Regents' policy on preservation of the collection should be modified to link NLM's preservation program more explicitly to its collection development guidelines, to clarify the Library's responsibility for the preservation of the content as opposed to the format of the biomedical literature, and to define NLM's role in assisting the preservation of significant biomedical literature held by other U.S. libraries.

The Preservation Planning Team recommends that the new policy encompass the following principles:

NLM should assume primary responsibility for the preservation of the core biomedical literature that the Library collects at the comprehensive level and should share with other research libraries responsibility to preserve literature in subjects related to medicine and health that it collects at the research level. NLM must ensure that the biomedical literature is preserved, but need not do all the preservation work itself.

NLM should seek to preserve the biomedical literature irrespective of the format (e.g., print, audiovisual, machine readable) in which it is published, but the Library's primary preservation responsibility is for the content of that literature rather than its format.

In making decisions regarding the order in which materials are to be preserved, NLM should give consideration to: the uniqueness of the material, its level of use, its state of deterioration, the existence of preservation copies elsewhere, the relationship of the material to existing cooperative preservation activities, and the availability of suitable preservation techniques. NLM should

monitor developments in preservation techniques and should participate in research, development, testing, and evaluation of preservation technology. In selecting preservation techniques, NLM should consider the likely future demand for the material, ease of use of the preserved original or preservation copy, the cost and reliability of the preservation method, and the cost of the long-term storage of the archival copies.

The Preservation Planning Team has prepared a draft policy statement for consideration by the Director, NLM and the Board of Regents. The full text of this draft statement is included in Appendix 5.

B. ESTABLISH A NEW ORGANIZATIONAL UNIT TO DIRECT NLM'S PRESERVATION PROGRAM.

NLM's existing preservation organization, while appropriate for the level of preservation activity currently underway, is inadequate to handle the expansion of preservation functions that the Library must undertake to ensure the preservation of the scholarly biomedical literature. What is needed is an organizational unit specifically devoted to preservation that can provide a focus for all NLM preservation activities and assume direct responsibility for many of them. Given present constraints, the new unit must be developed within existing ceilings for budgeted positions and FTEs. It should also continue NLM's current practice of contracting out most of the actual physical preservation or copying of materials to archival formats.

After examining several different options for NLM preservation organizations, the Preservation Planning Team recommends that a Preservation Section be established within the existing Reference Services Division. The core of the new Section should be formed by bringing together staff throughout Library Operations who now have preservation responsibilities. The Preservation Section will provide an operational focus for NLM's preservation program by initiating and managing the expansion of the level of preservation activity at NLM; monitoring developments in preservation technology and selecting appropriate techniques for the NLM collection; training staff and users in safe materials handling; developing cooperative preservation programs; and assisting in the identification of appropriate preservation research projects. While the Preservation Section will have major responsibility for NLM's preservation operation, the History of Medicine Division will continue to perform important preservation activities related to the special historical collections. The Lister Hill Center will conduct actual research related to preservation. (See Appendix 6 for a more specific rationale and list of recommended functions for the new Section.)

C. EXPAND THE LEVEL OF PRESERVATION ACTIVITY AT NLM

Because NLM has the largest collection of biomedical literature in the world, preservation of the materials held by the Library represents a significant step toward preservation of the entire scholarly record in the field of medicine and health. Since 1982, NLM's preservation activities have been limited to binding current materials, treatment of segments of the special collections, and preservation of archival films. With the completion of this comprehensive study of internal and external factors affecting preservation of the NLM collection, the Library should expand its preservation program to achieve by the year 2005 the goal of a preservation copy for every item in the NLM collection that falls within the subject areas that NLM collects at the comprehensive or research levels. NLM should take the following specific steps toward this goal:

C.1. Obtain by 1989 mass deacidification service for 100,000 NLM volumes annually.

Data on the condition of the NLM collection indicate that of 1.28 million volumes, at least 91.2% or 1.17 million volumes (boxes of theses or pamphlets were counted as volumes) would benefit from deacidification. At the estimated cost of $4.25 per volume ($2.25 for deacidification and $2.00 for preparation and transport to a local facility), it would take approximately $4.97 million to deacidify all of these volumes. Although it will not be cost-effective for NLM to review volumes individually to determine whether the Library has an obligation to preserve them, some categories of materials may be excluded from NLM's deacidification program based on their subject classification.

Approximately 40,000 volumes are added to the collection annually, and it will cost about $130,000 per year to deacidify these materials as they are received. This figure is based on an estimate of $3.25 per volume, since preparation costs would be reduced if deacidification took place as volumes were received or bound for the collection. NLM's costs for deacidification will be higher if the Library is required to fund all or part of the cost of building a facility.

Beginning in FY 1988, NLM should deacidify 100,000 volumes annually, including all incoming print materials that would benefit from this treatment and making up the remainder from items in the retrospective collection. Depending on the number of new materials acquired on acid-free paper or in non-print form each year, it will take 18-20 years to deacidify the entire retrospective collection that will benefit from this treatment, while also treating all appropriate incoming materials. The cost, depending on the mix of new and old materials, will range from $370,000 to $400,000 annually (in FY 1985 dollars) until all the retrospective collection has been treated. These cost figures are based on the use of an existing facility, and exclude any charges to defray the cost of facility construction. They are probably reasonable

estimates of what NLM can expect to pay for use of the LC facility if such use is permitted.

To make certain that mass deacidification services at the required level are available to the Library by 1989, NLM should negotiate with LC for a commitment for NLM use of the mass deacidification facility at Frederick. If sufficient capacity cannot be made available at the LC facility, NLM should work with other research libraries and/or commercial companies to ensure the development of adequate deacidification service for the NLM collection.

C.2. Initiate in FY 1986 a four-year preservation microfilming program for monographs and serial volumes too embrittled to benefit from deacidification.

The survey of the condition of the NLM collection revealed that an estimated 8.8% or 113,000 volumes (or volume equivalents) are brittle. Deacidification will provide relatively little benefit to this material, and disk storage is not yet available for large-scale preservation purposes. These volumes are in danger of crumbling into dust, and microfilming is at present the only available means of dealing with them.

Of the total number of brittle materials, an estimated 104,800 volumes are monographs or serial volumes. Of these an estimated 11,700 volumes have already been microfilmed. Using an average figure of 250 pages per monograph and 500 pages per serial volume, there are 32,118,000 brittle pages that have not been microfilmed. The cost of filming all these pages would be about 3.6 million dollars. These cost estimates are based on figures of $0.15 per exposure (for two printed pages) for creating the original master, $3.50 - $4.50 for the service master and the diazo service copy, and $9.00 per volume for preparation costs and recording preservation data. Some categories of brittle materials will not be filmed, however, because they deal with subjects for which NLM does not assume preservation responsibility or because preservation masters for them already exist. Given the space available for the growth of the collection, NLM has no immediate need to dispose of originals after they are microfilmed. The Preservation Section should be charged, however, with the responsibility for developing specific guidelines covering the retention or disposal of items for which preservation copies have been made.

Filming services are readily available from commercial companies or through an interagency agreement with LC. NLM can also obtain contract support for preparation of materials for filming, similar to the binding preparation services now purchased on contract.

Using contract support for preparation and an outside filmer, NLM should microfilm all brittle monographs and serial volumes in subjects it collects at the comprehensive or research level during FY 1986 - FY 1989. Expenditures for this program should be phased as follows: $600,000 in FY 1986; $1 million per year in FY 1987 through FY 1989.

The Library should assume that microfilming any post-1906 brittle materials in order to preserve them represents a "fair use" of the materials.

Treatment of brittle pamphlets and theses should be deferred pending resolution of the more serious problem of how the Library is to provide bibliographic control for these items.

In 1988/89, NLM should reassess any further use of preservation microfilming based on the results of research in techniques for strengthening paper and the preservation use of mass disk storage. Previously microfilmed images can be transferred to disk if this seems advisable at a later date.

C.3. Expand efforts to preserve items in the special historical collections.

In FY 1985, a total of $235,195 was allocated to preservation of rare books, historical films and modern manuscripts. Of this amount, approximately $115,000 was included in the original FY 1985 operating budget; the remainder was added when funds became available during the year, based on preliminary recommendations from the Preservation Planning Team.

To provide preservation treatment to untreated rare books currently in the NLM collection will require an estimated $362,000 in addition to FY 1985 expenditures. An additional $539,000 will be needed for making preservation and service copies of the historical films. Accurate cost estimates for preserving the entire collection of modern manuscripts are not yet available. A variety of techniques will be applied to these materials, i.e.,hand rebinding and deacidification, microfilming, and possibly strengthening of brittle paper, when this technique becomes available. As mentioned previously, a consultant will be engaged to advise on preservation of the prints and photographs collections. Cost figures will be based on the consultant's report.

Although exact cost figures are not yet available for full preservation of all elements of these collections, NLM should allocate at least $200,000 per year to preservation of special collections for the five-year period from FY 1986 - FY 1990. In 1988/89, NLM should be in a position to estimate the level of funding required for continuing maintenance and treatment of new acquisitions for these special collections.

D. CONTINUE RESEARCH ON THE PRESERVATION CHARACTERISTICS OF OPTICAL DISKS.

Optical disk storage has great promise as a preservation medium. At a minimum, disk storage probably will be the preservation medium of choice for materials published in machine-readable form. Due to its superior use characteristics, it also has strong advantages for printed

materials, particularly those that are likely to be used steadily over a long period of time.

Because of the great potential of optical disk as a preservation medium, NLM should continue to contribute to the development of knowledge about the preservation characteristics of this technology. The prototype Electronic Document Storage and Retrieval (EDSR) system developed in the Lister Hill Center should be used as a laboratory test bed for relevant research projects. LHNCBC budget plans for the next few years include appropriate funding for this activity. To ensure that the greatest amount of useful information is obtained in the shortest time frame, NLM's research efforts in optical disk technology should be closely coordinated with those of the Library of Congress, the National Archives, the National Bureau of Standards, and other interested institutions. In a preliminary meeting with NLM's Preservation Planning Team, LC staff expressed interest in cooperative research efforts.

E. ENCOURAGE PUBLICATION IN ARCHIVAL FORMATS

Publication of the scholarly literature on acid-free paper or in other archival formats will lessen the necessity for large-scale treatment of the prospective literature. To this end, NLM should launch a campaign to convince biomedical editors, societies, and publishers of the benefits of publication in archival formats. This campaign should involve a combination of direct appeals by NLM and cooperative efforts with other national libraries and library associations.

F. IMPROVE CONDITIONS FOR STORAGE AND USE OF THE NLM COLLECTION.

Proper storage and handling of library materials will extend their life. An examination of storage and use conditions at NLM has revealed that in general NLM's collection is stored in a benign environment and is handled with reasonable care. Steps should be taken, however, to ensure that this generally favorable situation continues and that specific problems are corrected. In addition to the corrective measures that were initiated during the course of the preservation planning process, the following actions should be taken:

F.1. Continue monitoring temperature and humidity levels; meet regularly with the NIH building engineer to review data collected and request any necessary adjustments.

The Library's system for controlling temperature and humidity is a good one, and the underground position of the stack levels helps prevent rapid or extreme fluctuations in these factors. Periodic adjustments to the system are necessary, however, to ensure that appropriate conditions are maintained. To assist in maintaining a good environment, the monitoring equipment installed during the environmental survey

should remain in place, and readings should be taken weekly. Data collected should be reviewed periodically with the NIH building engineer so any necessary corrective action can be taken promptly. As a member of the Task Force on Environmental Conditions, Mr. Herbert Crigger, the NIH engineer currently assigned to the Library building, has become aware of NLM's special environmental requirements and has been extremely willing to make adjustments to the Library's heating and air conditioning system. It is in NLM's best interest to continue this productive working arrangement.

F.2. Ask the NIH Division of Engineering Services to assess the feasibility and cost of retrofitting a chemical filtration system to the existing heating and air conditioning system to remove sulfur dioxide and nitrogen oxides from the Library's air.

The amount of sulfur dioxide and nitrogen oxides in the air of the Library building is well within the acceptable range for humans, but exceeds the standards for storage of Library materials. Sulfur dioxide is generally considered to be more harmful to materials than nitrogen oxides. LC's filtration system for the Madison Building removes sulfur dioxide, but not nitrogen oxides.

Although cost figures vary considerably depending on building size and the existing heating and cooling system, it may well be possible to put a chemical filtration system in the NLM Library building at an affordable cost. If the NIH Division of Engineering Services finds that such an improvement is possible, NLM should have the system installed.

F.3. Investigate the replacement of the photocopiers in use in the Library by machines with less potential for damage to library materials.

The air quality survey showed that ozone levels in the photocopier room adjacent to the Reading Room exceed the standard for an acceptable environment for library materials. Although high ozone levels were not noted in the B1 stack area (probably due to the larger air space there), the photocopiers in heavy use on the B1 level are of same type used by Reading Room patrons. These machines require bound volumes to be opened flat during photocopying. The machines on the B1 level are rented by the Library; the coin-operated copiers available to Reading Room patrons are owned by a commercial firm which is also responsible for their operation. NLM should investigate alternative arrangements that will have a more benign effect on the environment and on the bindings of printed library materials.

F.4. Establish a regular schedule for cleaning the NLM collection.

Steps already taken to have the stack floors cleaned more frequently should reduce the build up of dust and dirt on the collection. NLM should monitor cleaning of the stack areas to ensure that it is occurring as scheduled. The Library should also arrange for the materials

themselves to be cleaned and dusted periodically through a purchase order or contract arrangement. The heavily used B1 serial collection should be cleaned every three years; the B2 and B3 levels every five years. Approximate cost will be $10,000 per cleaning for the B1 collection and $50,000 for the combined B2 and B3 collections.

F.5. Develop a new long-range storage plan for the NLM collection.

The existing plan for the storage of the NLM collection provides for adequate storage of the projected acquisitions of the Library through the year 2000. This plan should be reviewed and revised in light of NLM's new preservation strategy. Issues that must be addressed include: the need for additional compact shelving, the amount of compact shelving the NLM building can accommodate, remote or onsite storage for NLM's expanding collection of microfilm masters, the number of materials that will be retained both in the original and preservation copies, and facilities for storage of disks and other machine-readable formats.

F.6. Develop an ongoing training program in safe materials handling for all NLM staff who process or use items in the collection.

All new employees who will handle items in the collection should receive instruction in materials handling when they join the staff. Regular update and refresher sessions should be held for experienced staff. A number of print and audiovisual aids covering recommended handling practices are available, reducing the need for development of inhouse training materials, but specific internal instructions should be developed by appropriate units. Employee performance standards should include reference to safe handling of materials, if appropriate.

F.7. Develop an awareness campaign for Library users describing the importance of safe handling to the preservation of the NLM collection.

Most damage to library materials is caused by simple ignorance or carelessness, not deliberate mutilation. Formal instruction for NLM patrons is not feasible; however, an effort can and should be made to alert patrons to proper handling procedures and the effects of mishandling and abuse. A set of instructional posters, signs and notices should be acquired or developed and distributed appropriately, both onsite and with outgoing interlibrary loans.

G. INITIATE AND PARTICIPATE IN COOPERATIVE PROGRAMS FOR THE PRESERVATION OF THE BIOMEDICAL LITERATURE.

Although NLM's first priority is the preservation of its own collection of materials collected at the comprehensive and research levels, it also has an obligation to engage in cooperative activities that will ensure

the preservation of materials pertinent to medicine held by other libraries and will contribute to a national preservation program. Key elements for a North American preservation program are in place or on the drawing board. These include leadership foci in the Council for Library Resources (CLR), the Research Libraries Group (RLG), the Association of Research Libraries (ARL), and the Library of Congress (LC); a growing body of standards related to preservation; increased funding for preservation from organizations such as the National Endowment for the Humanities; and a growing consensus that the magnitude of the problem demands a cooperative solution. While the emerging national program provides an infrastructure in which to fit the preservation of the biomedical literature, it does not presently address coverage of this subject area. NLM must assume the responsibility for the development of a plan to fill the gap. There are four major areas of opportunity in which NLM can initiate or participate in cooperative programs: (1) research, which was addressed previously in this report; (2) actual preservation of the literature; (3) ensuring access to preserved materials, and (4) education for preservation. Specific steps NLM should undertake are:

G.1. Establish Liaisons to Other Preservation Efforts.

NLM should move as expeditiously as possible to establish formal preservation liaisons with the other national libraries and with other major national preservation programs. There is little or no cost associated with such liaisons, and the payoff is potentially high. At a minimum, regular sharing of information about preservation programs may suggest fruitful program opportunities and may reduce duplication of effort.

Recently NLM, LC, and NAL have agreed on primary areas of responsibility for the acquisition of certain library materials in order to reduce the areas of collection overlap. It is important that these discussions continue, and that the national libraries also turn their attention to cooperative programs directed specifically toward preservation.

G.2. Work to Resolve Copyright Issues Related to Preservation of Archival Materials.

NLM must continue to pursue in concert with the national libraries and other professional library associations and organizations the resolution of copyright issues related to preservation, particularly as they relate to storage on disk and other readily accessible media. The goal must be to remove barriers to preservation of the literature while assuring due attention to the rights of publishers and authors.

G.3. Work with the RML Network and Other Library Groups to Develop a National Preservation Program for the Biomedical Literature.

Preservation of NLM's collection alone will not ensure that the needs of future health professionals and medical historians are adequately met. In-depth collections in specialized subject areas and numerous unique

titles not found at NLM exist in important health science library collections throughout the country. NLM does not and cannot collect comprehensively many biomedical materials published at the regional, state, and local levels. In addition, it is important to preserve more than one copy of significant materials to avoid their loss through a local disaster.

Plans for the next five years of the RML network include the development of a national preservation plan for the biomedical literature. In developing this plan, NLM and network libraries should collaborate with scholarly societies in establishing priorities for preservation. Once data are gathered on collections in each region and a suitable plan of action outlined, NLM should make some funds available for actual preservation of significant materials in other collections. NLM funds should be used as seed money or to supplement local resources.

G.4. Distribute Information About Materials Which NLM Has Preserved or Intends to Preserve.

In order to avoid wasteful duplication and to promote cooperative planning, it is essential that NLM provide access to information about the material which it has already preserved and which it plans to preserve. NLM should ensure that the MEDLARS III system design and file structures can accommodate display and distribution of preservation data. In addition NLM should work to promote cost-effective mechanisms for the transfer of data about what NLM is preserving to major reservoirs of preservation information.

G.5. Develop a Policy for Access to Preserved Materials.

As a follow-up to the work of the Preservation Planning Team, a committee should be appointed to develop an NLM policy statement describing the terms and conditions of access to the Library's preserved materials. The policy should cover onsite patron use, interlibrary loan, and duplication of preservation copies in whole in part for or by individuals, other libraries, or commercial institutions. In some cases it may be advisable to provide the originals of items for which preservation copies have been made.

G.6. Promote an Awareness of Preservation Issues Among Health Science Libraries and Broaden Their Access to Preservation Information.

NLM should work with the Medical Library Association, the RML network, and other appropriate groups to promote the awareness of preservation issues among health science librarians and medical historians and to broaden their access to preservation information. Although large-scale preservation programs are likely to be needed only at a small number of major health sciences libraries, an increased awareness of preservation issues affecting the health sciences community is desirable at all levels of the network.

H. RE-EVALUATE NLM'S PRESERVATION PROGRAM PERIODICALLY

Like other NLM programs, the preservation operation will be monitored through regular reporting mechanisms and the program review that accompanies budget preparation and approval. Given the new emphasis to be placed on preservation, NLM should also perform a broader review of progress toward the goal of preservation of the biomedical literature at approximately three-year intervals. During this review, NLM should reassess its preservation assumptions and strategies in light of the current and future information needs of the Library's users and developments in preservation technology.

Tables 7 and 8 provide a summary of recommended preservation activities and budget levels for the next five years.

Table 7

SCHEDULE FOR RECOMMENDED STRATEGIES FOR PRESERVATION AT NLM

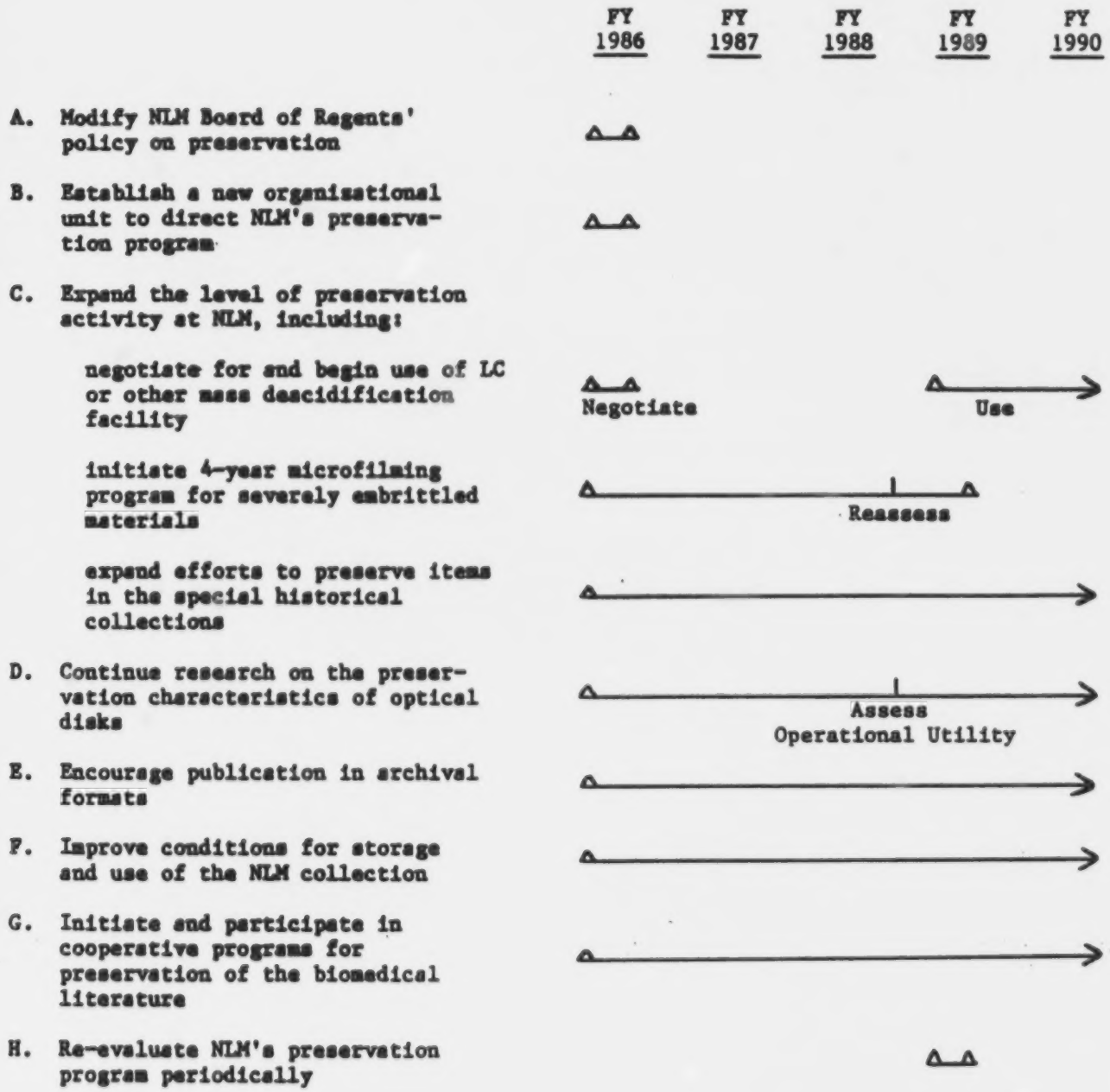
FY 1986
FY 1987
FY 1988
FY 1989
FY 1990
A. Modify NLM Board of Regents' policy on preservation
B. Establish a new organizational unit to direct NLM's preservation program
C. Expand the level of preservation activity at NLM, including:
negotiate for and begin use of LC or other mass deacidification facility
Negotiate
Use
initiate 4-year microfilming program for severely embrittled materials
Reassess
expand efforts to preserve items in the special historical collections
D. Continue research on the preservation characteristics of optical disks
Assess Operational Utility
E. Encourage publication in archival formats
F. Improve conditions for storage and use of the NLM collection
G. Initiate and participate in cooperative programs for preservation of the biomedical literature
H. Re-evaluate NLM's preservation program periodically

Table 8

MAJOR PRESERVATION PLAN BUDGET ITEMS
(Dollars in Thousands)

	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
Mass Deacidification	—	—	—	$400	$400
Microfilming	600	1,000	1,000	1,000	
Special Collections Preservation	200	200	200	200	200
TOTAL	$800	$1,200	$1,200	$1,600	$600

The actions proposed will require significant effort by staff throughout the Library and the expenditure of large sums of money. By making a commitment at this level NLM can fulfill its statutory function to preserve the biomedical literature.

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Appendix 1

PRESERVATION AT THE NATIONAL LIBRARY OF MEDICINE

Background Paper

NLM Preservation Planning Team

November 1984

A. INTRODUCTION

In 1983, Library Operations (LO) senior staff developed a strategic plan for 1984-88 which includes as one of its four broad objectives:

> to develop and implement a program for the preservation of the biomedical literature.

Preservation of the scholarly records is one of the most important challenges facing research libraries today, requiring significant expenditures of resources, the interest and involvement of all staff who process or use the collection, active cooperation among many institutions, and new organizational approaches.

As a first step toward developing NLM's preservation program, the Associate Director for Library Operations appointed a senior Preservation Planning Team on August 29, 1984. The members of this group are:

Duane Arenales
Acting Chief, Technical Services Division, LO

James Cain
Acting Chief, Reference Services Division, LO

John Parascandola, Ph.D.
Chief, History of Medicine Division, LO

Mark Rotariu
Chief, Office of Financial Management, Office of Administration

Linda Watson
Head, Audiovisual Resources Section, RSD, LO

Betsy Humphreys - Chairperson
Deputy Associate Director, LO

George Thoma, Ph.D. - Consultant
Chief, Communications Engineering Branch
Lister Hill Center

The Team has been asked to:

1. Assess the current physical state of the collection.

2. Assess the conditions under which the collection is used, processed, and stored.

3. Examine current preservation activities in all LO components.

4. Identify and evaluate available preservation techniques.

5. Identify current and potential cooperative preservation activities.

6. Develop a plan for the preservation of the NLM collection which includes recommendations for:

   a. organizational responsibility for NLM preservation activities

   b. general guidelines for selecting items to be preserved and assigning preservation priorities

   c. methods for preservation of various parts of the collection including cost data and selected schedules

   d. necessary changes to environmental conditions and processing and use practices

   e. cooperative activities NLM should participate in or initiate

The report of the Preservation Planning Team is due in May 1985.

The planning process being used for this project is modeled on a self-study procedure developed by the Office of Management Studies (OMS) of the Association for Research Libraries (ARL) and described in Preservation Planning Program: An Assisted Self-Study Manual for Libraries. NLM has contracted with OMS for assistance in developing the plan and the results of NLM's effort will be shared with the ARL and biomedical library communities. Ms. Jutta Reed-Scott serves as principal OMS consultant to NLM for the project.

The planning process consists of three phases. During the first phase, the Preservation Planning Team reviews basic preservation issues; assembles background information about the library to provide a context for the examination of its preservation needs; and defines the next phases of the planning process, including their schedule, objectives, and participants.

The second phase involves a variety of Task Forces gathering and analyzing data and developing recommendations in several specific areas affecting preservation, e.g., the environment in which the collection is housed, the present physical condition of the collection, organizational responsibility for preservation activities.

In the third and final phase, the Preservation Planning Team studies the information assembled by the Task Forces, weighs alternative approaches, and develops a recommended plan of action.

This document is the outcome of the first phase of the planning process. It is organized into the following Sections:

A. Introduction
B. Institutional Setting of the National Library of Medicine
C. Preservation History and Practices
D. External Factors Affecting NLM's Preservation Program
E. Planning Methodology

B. INSTITUTIONAL SETTING OF THE NATIONAL LIBRARY OF MEDICINE

HISTORY

The National Library of Medicine can trace its origin back to 1818 or 1819 when the Surgeon General of the United States Army, Joseph Lovell, began to acquire books and journals needed for his work. However, the year of birth of the Library is generally considered to be 1836, when a request for funds for books ($150.00) first appeared in the estimate of expenses for the Surgeon General's Office. Under the direction of John Shaw Billings from 1865 to 1895, the collection of books began to take shape as a library, where in one place were assembled and organized the major medical books, journals and other important medical documents of Western Civilization.

In 1922, the Library of the Army Surgeon General's Office became the Army Medical Library, and three decades later, a joint agency of the three military departments. In 1956, Senators Lister Hill and John Kennedy submitted to Congress Bill S. 3430, "to promote the progress of medicine and to advance the national health and welfare by creating a National Library of Medicine." The bill was passed by Congress and signed into law on August 3, placing the Library within the Public Health Service. Funds were authorized for the construction of a new library building on the grounds of the National Institutes of Health in Bethesda, Maryland. Occupancy began in 1962, although the Library did not formally become a Bureau of NIH until 1968, the administrative structure which exists today. From a few books in a physician's office, NLM has become the world's largest research library in a single scientific and professional field, serving as a national resource for all US health professionals.

MISSION

The Act establishing NLM as a national library in 1956 (PL-84-941) authorized NLM to perform the following functions:

1) acquire and preserve library materials pertinent to medicine;
2) organize the materials by appropriate cataloging and indexing;
3) provide information about the materials in the collection through publication and other means;
4) make materials in the Library's collection available through loans, photocopies or other methods;
5) provide reference and research assistance; and
6) engage in such other activities as deemed appropriate.

LIBRARY RESOURCES AND ORGANIZATION

The National Library of Medicine is divided into 5 major divisions: Library Operations, the Office of Computer and Communications Systems, Specialized Information Services, the Lister Hill National Center for Biomedical Communications and Extramural Programs. Overall policy direction and administrative services are carried out by the Office of the Director and the Office of Administration. The current full-time permanent staff of NLM is 487. With part-time and other personnel, the total FTE equivalent is 536.

NLM's FY 1985 budget is $55,910,000. Over the past five years, there has been a trend of moderate growth. Excluding additional funds realized in FY 1985 for extramural grant programs, the total NLM budget has grown at an average rate of about 4% per year. It is reasonable to assume continued overall growth at the same rate for at least the near future. The budget for literature acquisition has increased at a greater rate to keep pace with inflation and this is also likely to continue.

Library Operations (LO), the largest of NLM's five Divisions, performs the first five of the Library's mandated functions and assists in the performance of the sixth. Its FY 1985 budget of $17,081,000 includes salaries, literature acquistions and other support costs such as equipment and contract activities. The current full-time permanent LO staff of 234 (350 total FTEs) is divided into four divisions: Technical Services (TSD), Bibliographic Services (BSD), History of Medicine (HMD), Reference Services (RSD), and two other units, Medical Subject Headings (MeSH) Section and the Regional Medical Library (RML) Program.

The Lister Hill National Center for Biomedical Communications is the division of NLM responsible for research and development activities. Currently the Center is investigating the potential of optical disc technology for document preservation, storage and retrieval which may eventually be applied to the Library's preservation problem. Approximately $650,000 in FY 1985 funds are devoted to this project.

The Library collects materials comprehensively in all major areas of the health sciences and to a lesser degree in such areas as chemistry, physics, botany and zoology. The collections today stand at 3.1 million items in a variety of formats including books, journals, audiovisual materials, microfilm, manuscripts and prints and photographs. An annual literature budget of about $2.2 million supports the acquisition of approximately 16,000 books and 1,000 audiovisuals, 21,000 serial titles, 33,000 manuscript items, and 450 prints and photographs.

The Library's computer-based Medical Literature Analysis and Retrieval System (MEDLARS) was established to achieve rapid bibliographic access to NLM's vast store of biomedical information. MEDLARS is used to generate a number of catalogs and indexes, and its machine readable databases are available for online searching directly on the NLM computer and through commercial database vendors and international cooperative partners that lease NLM files. Last year some 2.5 million computerized searches of these databases were performed on the NLM system alone. The availability of information about NLM's collections through this mechanism increases the demand for physical access to the materials themselves. Lending and other services are coordinated through a Regional Medical Library Network with the NLM as the "library of last resort" for the location of hard to find or unique items. Some 2 million interlibrary loan requests are filled each year within this network; NLM accounts for over 142,000 of these. The Library circulated an additional 211,000 volumes to onsite patrons in the Reading Room in FY 1984.

PRESERVATION IMPLICATIONS

The Act establishing the Library gave NLM responsibility for preservation of the literature pertinent to medicine. Although significant attention has been devoted to preservation activities at NLM already, NLM's printed collections contain the seeds of their own destruction in the form of high acid content paper which, over time, causes discoloration, embrittlement, and finally disintegration. In addition, the Library faces special problems related to the conservation and preservation of the archival microfilm and historical motion picture film collections and the History of Medicine Division's manuscripts, older printed works, prints and photographs.

If NLM is to carry out its statutory mandate successfully, the Library must develop a more comprehensive approach to preservation that makes effective use of existing resources, emerging technologies, and cooperative arrangements with other libraries. To this end, LO has identified the development and implementation of a preservation program for the biomedical literature as one of its four broad objectives for FY 1984-88.

C. PRESERVATION HISTORY AND PRACTICES

THE COLLECTIONS

The small collection of books and journals in the Surgeon General's Office initially grew rather slowly. The Library's first catalog, a handwritten manuscript prepared in 1840, records only 134 titles, representing some 200 volumes. It was far smaller at the time than many personal libraries of physicians, not to mention the libraries of various medical societies and institutions. When the Library came under the charge of John Shaw Billings in the fall of 1865, it still contained only about 1,800 volumes. Under his direction the collections expanded dramatically. Sometime during 1871, a decision was made to broaden the objectives of the Library to include service to the entire American medical profession, not just the military. By the time Billings left the Library in 1895, the collections had grown to encompass some 73,475 books, 39,412 volumes of journals and transactions, and over 200,000 individual pamphlets and theses. During Billings' tenure, the Library also made its first significant efforts to acquire rare books, manuscripts, and prints and photographs in the history of medicine.

Over the course of the twentieth century the collections continued to grow as the National Library of Medicine became the largest institution of its kind in the world. The collections of printed materials now total some 500,000 monographs, 700,000 bound serial volumes, 170,000 pamphlets and 280,000 dissertations. In addition, the small special collections, such as manuscripts and photographs, have expanded into large collections directed by specialized librarians. The Library currently houses about 70,000 prints and photographs and over 1,000,000 manuscript items.

The variety of formats collected also increased. The incorporation of the National Medical Audiovisual Center into the Library in 1967, for example, led to a program of active acquisition of audiovisual materials. Today the audiovisual collection consists of some 6,000 videocassettes, 9,000 audiocassettes, 2,000 16mm films, 2,000 historical films, 1,000 filmstrips and 240,000 slides. The Library's microform holdings total approximately 34,000 reels of microfilm and 122,000 microfiche. Technology continues to add to the types of formats which the Library collects (e.g., computer software, videodiscs).

The formats represented in the Library's collections are as follows:

1. Printed Literature (books, journals, pamphlets, etc.)
2. Manuscripts
3. Art Prints
4. Photographs
5. Oil Paintings (a small number, but a few are valuable)
6. Microfilm and Microfiche
7. Videotapes
8. Audiotapes
9. Slides and Filmstrips
10. Motion Picture Films
11. Pre-Columbian Art (about 40 clay sculptures)
12. Computer Tapes and Discs
13. Videodiscs

There may be a small number of other types of materials (e.g., phonograph records) contained in the collections, but the above categories would appear to include all of the formats that are relevant to the present preservation study.

Because of its archival responsibility, the Library has not had a systematic policy for weeding the collections (except in the case of added copies). By and large items incorporated into the collections are retained, although materials considered out of scope or peripheral are periodically withdrawn upon the recommendation of staff members. There is no written policy concerning replacement of lost materials, but current works which are still in print are ordinarily replaced if identified as lost. The Library also actively seeks to fill gaps in its journal runs.

PHYSICAL FACILITIES

In the early decades the small collection of publications moved with the Surgeon General to various offices. From 1862 to 1866, the Surgeon General's Library was housed in the front parlor of a two-story building which had originally been a private home. It was adjacent to and owned by the Riggs Bank located at Pennsylvania Avenue and Fifteenth Street, N.W. In 1866, the Library moved to a remodeled Ford's Theatre, which was closed and purchased by the government after the assassination of President Lincoln. The collections remained in Ford's Theatre until a new building was constructed on the mall specifically to house the Surgeon General's Museum and Library. The new quarters were occupied in August of 1887, and this structure continued to house the Library until the present building in Bethesda was ready for occupancy in 1962.

Physical conditions for the storage of rapidly expanding collections were poor in the post-Civil War years. Ford's Theatre had been hastily erected and was poorly constructed. The increasing weight of books, museum specimens, etc. placed stresses on the floors and walls that the building had not been designed to bear. (In fact, the interior collapsed during renovations in 1893, a few years after the Library had moved out of it.) The building was also not fireproof.

The building on the mall provided the Library with a decent, if not ideal, home for the first time. The structure, with its brick walls, concrete floors, and ironwork, was practically fireproof. Billings himself designed the 25-foot-high iron book stacks. The Library had no artificial illumination (except for a few gas lights) until it was wired for electricity in 1900. The building was heated by hot air from a coal-fired steam boiler, and a few fireplaces, but Library Hall was so large that it proved impossible to warm adequately on extremely cold days. Needless to say, temperature and humidity must have fluctuated widely during the course of the year.

Certain rare books (e.g., incunabula) had been segregated from the collection and housed in display cases even when the Library was still in Ford's Theatre. Many of the Library's historically valuable books and manuscripts, however, were scattered throughout the stacks with other publications. It was not until the Second World War that a separate History of Medicine Division was established and the historical collections brought together in one place. Fear that Washington might be bombed led to a concern on the part of libraries and museums for the protection of the nation's cultural treasures. A decision was made at the Army Medical Library to find a home in the midwest for the Library's pre-19th century books, and the Allen Memorial Library Building of the Cleveland Medical Library Association was selected. Beginning in August of 1942, 952 boxes of historical materials were sent to Cleveland. Although the books were originally scheduled to return after the war, because of lack of space in the building on the mall the historical collections remained in Cleveland until the new building in Bethesda was occupied in 1962.

During the war space became an increasing problem for the Library. Tens of thousands of books had to be housed in other buildings in the mall area. Some of these buildings were temporary structures and provided poor physical conditions for the books. The main Library building itself was suffering from deterioration due to age and lack of proper maintenance and leaked badly during heavy rain.

The completion of a new building on the NIH grounds provided the Library with greatly improved physical facilities. The Bethesda building is constructed of reinforced concrete and steel with exterior walls of limestone, granite and marble trim. Much of the structure, including most of the shelving for books, is below ground level, reflecting the concern of civil defense planners of the 1950's for potential atomic attack. This defensive planning also led to the insertion of narrow, recessed windows on the main floor.

The building is heated by low pressure steam and air conditioned. Preliminary data suggest that temperature control may be a lesser problem than humidity control. Temperature seems to be in the 70° range year round. There is some humidity control but available evidence suggests that humidity may range from as low as 35% in the winter to 55% or above in the summer. Fluorescent bulbs in the stack areas are supposed to be covered with ultraviolet filter sleeves, but this is not always the case. Sleeves may not always be replaced when bulbs are changed. It is also not clear whether the fluorescent bulbs in some

areas with glass-paneled ceilings, such as the prints and photographs room in the History of Medicine Division (HMD), have filter sleeves. According to the building engineer, air entering the Library is filtered only for dust. There is no chemical filtration to eliminate acid fumes such as sulfur dioxide.

The building is protected against fire by a water sprinkler system. The rare book collections (incunabula room and B1 stacks in HMD) are protected by a carbon dioxide fire extinguisher system. The Library has in the past considered replacing carbon dioxide with halon, which presents less of a threat to the safety of employees, but no action has been taken in this direction. In accordance with the federal policy of "self-insured" protection, neither NLM nor its collections carry special insurance against damage or loss.

Facilities for exhibiting portions of the collections, which is done on a regular basis and frequently involves rare books, are not ideal. The cases used have locks, but would be easy to open. The plastic tops do not filter out ultraviolet radiation from natural or artificial light.

The Library's security system includes electronic surveillance and a search of bags, briefcases, etc. by a guard as patrons and staff leave building 38. Large portions of the collection, including rare books and manuscripts, are not provided with security labels and would therefore be undetected by the electronic security system. Access to the historical collections is more restricted, however, than access to the general collections. There is no evidence that loss by theft has been great over the years, but the theft of an infrequently used item can go undetected for a long time.

The Library is fortunate in not having suffered any major disasters. A disaster plan was implemented in 1979 and revised in 1983. The emphasis of the plan is on water damage.

COLLECTION MAINTENANCE PRACTICES

The collections are largely housed in metal stacks. Journals from the period 1871-1969 are housed in compact shelving and it is anticipated that over the next two years many more items will be transferred to existing or newly-installed compact shelving (e.g., 1970-1974 journals, nineteenth century books and journals, HMD pamphlets and dissertations). It would be worth investigating whether long-term storage in compact shelving creates unique preservation problems. For example, could it lead to high concentrations of certain pollutants in a localized area?

Certain specialized collections are housed under special conditions. Archival microfilm and the historical film collections are preserved in special cold storage vaults. Acid-free Hollinger boxes and folders are used to house the collections of personal or organizational papers in the Modern Manuscripts collection in HMD. Fine art prints are stored flat in special cases.

In one sense, access to the Library's collections is limited in that the stacks are closed to the public. Except for NLM staff, readers may not check out materials but must use them in the Reading Room. There are exceptions to the closed stack policy, however, and stack passes to the general collections are not infrequently given to readers who can demonstrate a need to use a large body of literature, such as long runs of journals. The History of Medicine Division does not issue stack passes.

In another sense, however, access to the collections is much more open because of the interlibrary loan process. The great majority of interlibrary loan requests are for current journal articles, and these are handled by sending out photocopies, but monographs and videocassettes from the general collection are regularly sent out on interlibrary loan to requesters in the United States and Puerto Rico unless they are in poor condition. Journals and all audiovisual formats may also be loaned to the NIH Library. The History of Medicine Division also sends out some original items on loan (e.g., current books on medical history housed on its reference shelves). Most items in the historical collections are not loaned in the original, but are microfilmed or photocopied.

Materials coming into the Library receive a good deal of handling in processing. Items are checked in, cataloged, stamped, marked, labelled with security labels and machine-readable identifiers (MRIs), shelved, and in some cases indexed. The impact of these procedures on preservation has not been fully examined. For example, does the adhesive used to affix labels contain acids or other chemicals which might damage the books or audiovisuals?

Journals are bound with a class A binding (standard library binding). Softbound books have traditionally been bound in the same way. Acid-free end papers are used. There has been relatively little in the way of repair of bindings of items in the general collections. Some items have been rebound when necessary. In recent years, questions have been raised about the advisability of rebinding certain items, or about binding all softcover books in the first place. Each time a book is bound or rebound, there is a loss in trim, which can lead to tightly bound volumes which are difficult to use or copy. The repair and rebinding of rare books is discussed below.

Library materials also are subject to wear and tear through reader use. Items can also be damaged in shipment on interlibrary loans. Photocopying of books and journals can be hard on the materials, especially if done carelessly. Possibly more attention should be devoted to training staff and patrons in how to handle materials when photocopying. Perhaps greater restrictions should be placed on photocopying of certain materials by patrons. It would also be worthwhile to investigate whether the present photocopy machines in the library could be replaced by machines which cause less damage to materials. Microfilming causes less damage to books than photocopying, but nevertheless involves some wear and tear on the materials. The same is true for the photographic processes used to prepare photographic

prints, slides or negatives from visual materials in books or in the prints and photographs collection.

Patrons are not permitted to do their own photocopying of rare books, manuscripts or prints and photographs. The History of Medicine Division ordinarily microfilms materials from rare books, but may use a photocopy machine instead if only a few pages are involved. Modern manuscripts are often photocopied for patrons. Sometimes original photographs are photocopied, a procedure which may not be advisable unless some type of protective filter device is available to reduce exposure of the photograph to harmful radiation.

EVOLUTION OF NLM PRESERVATION ACTIVITIES

The term preservation is used in this report in a broad sense. To quote from the ARL Preservation Planning Program self-study manual which has guided the work of this Preservation Planning Team:

> The preservation of a library's collections and/or of the information contained within its collections is dependent on a broad spectrum of environmental conditions, processing and storage procedures, binding and repair practices, use patterns, replacement policies, and a complex set of technical problems related to the physical components of the materials themselves.

Many activities that go on in the Library could therefore be considered as relating to preservation. This section will focus, however, on significant efforts undertaken by the Library for the specific purpose of preserving some portion of the collection.

Perhaps the first large-scale preservation effort undertaken by the Library took place while the historical collections were in Cleveland. When the books arrived in Cleveland, it was found that several thousands of them were in poor condition. Covers were warped, spines were broken, pages were loose, leather bindings were torn and crumbling, etc. It was estimated that three-fourths of the pre-1800 volumes needed restoration. In 1943 a contract was entered into with the National Library Binding Company, East Cleveland to repair and rebind the early books and to machine-bind later books, pamphlets and documents. Over the next twelve years, 10,317 operations were carried out on 9,917 volumes. Original bindings were repaired if practical, but a decision was made to treat the books as part of a research library and not as museum pieces. Therefore many books were rebound to restore them to a condition where they could be handled easily and without damage.

No further preservation work was done on the historical collections after their move to Bethesda until 1969. In that year the Library began contracting with experienced hand book binders to restore or rebind rare books. Between 1969 and 1982 a total of 3,407 volumes were restored or rebound. At the present time the Library is budgeting $37,000 per year for the treatment of rare books (oiling of bindings, deacidification, repair, restoration, and rebinding).

Another current preservation activity in the History of Medicine Division is a project involving the transfer of the Library's collection of portraits to acid-free folders and boxes. Two valuable oil paintings, the portraits of Billings and of Fletcher, are also being cleaned and restored.

One of the major preservation concerns facing libraries today involves post-1850 printed works. Mass produced chemically digested woodpulp paper entered commerce around 1850 and most books and journals published since 1870 were printed on it. This paper is inherently weak because of the short fibers in wood pulp and because of its relatively high acid content. Consequently many of NLM's post-1850 books and journals are steadily deteriorating, the pages becoming brittle and crumbling. Beginning in the 1950's the Library initiated a program of microfilming the badly deteriorated materials. A survey indicated that the shelves of the Library held about 350 million pages, over 90% of which had been printed since 1870 on woodpulp paper. Some 37 million pages were considered to be fully deteriorated, and it was estimated that number would increase to 262 million by 1989. In 1966, the Library increased the pace of the microfilming program under contract with commercial firms and also made several large scale purchases of commercially microfilmed serials. Although the Library continues to slowly build an archival microfilm collection through the microfilming of items requested on interlibrary loan which are considered too valuable or too fragile to send in the original, the large-scale preservation microfilming program came to an end in 1982 largely because of the promise of new technologies and the difficulties in selecting which small percentage of the total should be filmed with the limited resources available. About 2,000 serial titles and 3,000-4,000 monographs from the period 1871-1906 were microfilmed during the course of the program.

Experiments conducted at the Library's Lister Hill Center and at the Library of Congress have been exploring the potential of optical disc technology for mass storage of text. Various institutions, including the Library, have also been investigating the potential of videodisc for the storage of graphic images. The Lister Hill Center and the History of Medicine Division have completed an experimental videodisc containing about 1,000 images from the prints and photographs collection. Although this technology may not eliminate the need to store the original image, it has preservation implications as the handling of original materials will be greatly reduced if patrons and staff can use the disc for searching the collection to locate desired images. Similarly, the Library's historical film collection is being transferred to video tape so that the tapes may be viewed instead of the original films. Some $70,000 has been budgeted for the activity in FY 1985, which will accommodate approximately 10% of the present historical film collection.

D. EXTERNAL FACTORS AFFECTING NLM's PRESERVATION PROGRAM

NLM's preservation program must take into account a number of external factors affecting the U. S. information and biomedical communities. These include publishing trends, developments in the concept of intellectual property, changes in the ways health professionals acquire and use information, the emergence of preservation as a critical concern, and an increased emphasis on cooperative library activities.

PUBLISHING TRENDS

Publishers are the primary source of NLM's raw materials--the books, periodicals, audiovisuals, prints and other library materials which make up the Library's collection. The publishing industry, therefore, initially determines the dimensions of the preservation problem which NLM will face.

For over a 100 years the trend has been toward lower cost, higher speed production of an ever increasing flood of publications, which because of the acid paper, adhesives and binding techniques used in their manufacture, are subject to rapid deterioration. As the library community has become more aware of the inherent weakness of the materials it collects, it has attempted to pressure publishers to shift to methods which will ensure more durable products. Partially as a result, this fall the National Information Standards Organization (NISO) will publish a standard for permanent durable paper with alkaline reserves. However, on the whole, the U.S. publishing industry appears to see little or no economic advantage in producing more durable print products.

The definition of a "publication" has changed with the emergence of new media. An increasing amount of material is published in microform, especially computer-output-microfiche (COM); however, this medium too is subject to gradual destruction. Audiovisuals and electronically-based forms of information are proliferating daily and will present the Library not only with bibliographic, acquisition and service problems, but also with difficult preservation problems.

INTELLECTUAL PROPERTY

Related to publishing trends are a spectrum of issues concerned with intellectual property rights. The question of who shall be reimbursed for what kinds of use of what kinds of "publications" is under continuing review as information becomes an increasingly valuable commodity. This in turn affects the form and conditions under which publications may be reproduced or re-stored for preservation purposes. State of the art videodisc and optical disk technology for mass storage also may lend themselves to ready redissemination of information. As a result efforts to provide technical solutions to mass preservation problems may become enmeshed in the issues of intellectual property rights.

NLM's public information activities and their effect on the private sector have been subject to close scrutiny for the past several years, and this is an issue to which we must be particularly sensitive.

CHANGES IN THE WAY HEALTH PROFESSIONALS ACQUIRE AND USE INFORMATION

Health professionals traditionally have demanded rapid access to information. Health sciences librarians traditionally have responded by providing the best or developing the newest in information services. In the last ten years microcomputer technology and the proliferation of online databases have profoundly affected the way health professionals acquire and use information. Artificial intelligence systems, electronic publishing, and developing "electronic colleges" have the potential for making even more significant changes. If current trends in hospital economics continue, there will be few libraries available close at hand to fill immediate needs. It is likely that there will be increasing numbers of technologically sophisticated physicians tapping into remote information resources both for current and older materials. The challenge to NLM then is not just to preserve the biomedical literature, but to preserve and store it in ways which will facilitate access for our user community and be appropriate to their changing needs.

EMERGENCE OF PRESERVATION AS A CRITICAL CONCERN

Over the last 25 years the Council of Library Resources (CLR) has acted as a catalyst to focus the attention of the library community on preservation as a critical concern. In large measure as a result of CLR's efforts, significant progress has occurred in three areas. The first is a developing consensus on the dimension of the preservation problem which libraries collectively face, a recognition of the cost of confronting it and of the cost of failing to confront it. The second is a developing research effort which addresses methods to prevent or retard deterioration of library materials on the one hand and methods for mass storage of already deteriorated materials or as a prospective preservation measure on the other. A number of efforts have concentrated on the development of an effective, affordable deacidification, or as it might more accurately be termed a neutralization process, for the acid paper already present in millions of volumes.

The Library of Congress has patented a mass deacidification process using diethyl zinc (DEZ) vapor and recently received funding for a facility capable of processing 500,000 volumes per year. LC plans to treat its annual intake of about 300,000 monographs plus 200,000 older volumes. A cooperative plan for preserving medical works in this way could perhaps be negotiated with LC. There are two other deacidification systems, the Wei T'o being tested by the Public Archives of Canada and an unnamed process developed by the Koppers Company of Pittsburgh. The University of California at Berkeley has announced plans to undertake independent testing of the three techniques with results expected to be available sometime in 1985.

Both NLM and the Library of Congress are actively engaged in research to test the application of videodisc and optical disc technology for preservation purposes. LC is testing a commercial analog videodisc system to store a variety of graphic materials including motion pictures

and prints and is developing an optical digital disc system to test storage of about half million pages a year of material from high use serials. Plans are now in place to test user response to the systems at LC.

NLM's Lister Hill National Center for Biomedical Communications has demonstrated the feasibility of video disc technology for storage of medical prints and photographs and also has completed the first phase of a research and development program in electronic document storage and retrieval.

Preservation has emerged as a specialty within the library profession. Interest and expertise has spread beyond the circle of archivists and rare book librarians. Beginning in 1981,Columbia University announced a degree program for conservation and preservation and the number of courses, workshops, and institutes announced by other library schools and organizations has proliferated. While there is a developing pool of trained and partially trained preservationists, there also is a developing demand for this type of expertise. The October issue of American Libraries, for example, listed several positions available in the field of preservation.

The Association of Research Libraries Office of Management Studies has developed a Preservation Planning Program "to enable academic libraries to identify and address preservation problems". The National Endowment for the Humanities has awarded the Association a two-year grant to fund ten ARL institutions to serve as demonstration sites for the program during 1984-1986. Participation in the program is expected to result in a report and action plan for each institution to enhance its preservation goals and to provide a thorough test of the OMS program as a blueprint for other libraries. NLM, though not a recipient of NEH grant funds, has selected the ARL/OMS program to structure its planning effort.

COOPERATIVE LIBRARY ACTIVITIES

In 1959 reports of studies by William J. Barrow, a Virginia document restorer, on the physical strength and stabilization of modern book papers began to alert the library community to the present state of and future dangers to their collections. In 1960 after a discussion of Barrow's findings, the Association of Research Libraries appointed a standing committee on Preservation of Research Library Materials. According to Pamela Darling, noted preservation specialist with ARL, this led over the next 12 years to the "articulation of a broad-scale cooperative approach to the nation's preservation problems." In 1962 CLR, which had partially funded Barrow's research, funded an ARL study to provide a framework for national planning by assessing the "magnitude of the paper-deterioration problem." The study concluded that in terms of pages rather than titles, 60 percent of the material listed in the National Union Catalog in 1961 was probably printed on paper subject to rapid deterioration. A second CLR funded effort was mounted to find a solution to the paper-deterioration. The result, a study by Gordon Williams entitled The Preservation of Deteriorating Books: An Examination of the Problem with Recommendations for a Solution

concluded that the best way to deal with the problem was to establish a federal agency which would preserve a physical copy of each significant work and make copies available to other libraries. ARL adopted the report and in 1965 called for the Library of Congress to take on this responsibility. In 1965 the Librarian of Congress accepted the challenge and stated that the "Library of Congress will assume responsibility for a national program for the preservation of deteriorating books in accordance with the principles set forth in the Report. . . by Gordon R. Williams."

Through ARL the CLR provided funding for the Pilot Preservation Project at the Library of Congress to begin this work and LC initiated research which led to the about to be implemented mass storage and deacidification projects.

In 1976 LC called for a "Planning Conference for a National Preservation Program". The Conference identified research, educational and cognitive efforts as critical to resolving the problem of deteriorating library materials. An ad hoc advisory committee to LC was established and met twice focusing its attention "on the need for automated bibliographic control of microforms as the foundation for a coordinated preservation filming program." In the late 1970s LC went through a series of reorganizations and budget reductions. According to Darling, this resulted in a concentration on its own preservation problems and at least a temporary turning away from a national program.

The same time period saw the beginning of a number of other cooperative efforts. The American Institute for Conservation began to place increased emphasis on library materials, and in 1973 a National Conservation Advisory council was established "to serve as a forum for cooperation and planning" related to the conservation of cultural property. The Harvard, Yale, Columbia, New York Public Library consortium, which later served as the nucleus for the Research Libraries Group (RLG), established an active preservation committee, and initiated RLG's cooperative efforts to bring together bibliographic data for members' master negative microfilms. With funding from the National Endowment from the Humanities RLG members input into the RLIN database records for more than 25,000 microfilm masters held by member libraries. LC has announced plans to participate in this effort. The project is primarily intended to prevent duplication of filming efforts. More immediately it has resulted in the publication in June 1984 of the first edition of the RLG Preservation Union List.The RLG Medical and Health Science Libraries Program Committee at its October, 1984 meeting indicated that member institutions plan to develop a cooperative approach to preservation of their biomedical collections.

In 1981 ALA established a division level Committee on the Preservation of Library Materials and in 1982 the OCLC Research Library Advisory Committee established a task force charged with studying the feasibility of tagging online records to identify volumes that have been designated as preservation copies. ARL has continued its strong interest in preservation, developing the self-assisted process for preservation planning that NLM has adopted and emphasizing the development of preservation programs in its member libraries in the ARL strategic plan. CLR currently is planning major new initiatives in the areas of preservation and LC has announced an international preservation meeting to be held in Washington in the summer of 1985.

Within the medical library community, the Union Catalog of Medical Periodicals in the Greater Northeastern Region represents an early effort to identify cooperative responsibility for retention of medical periodicals and the Pacific Southwest Region has developed a cooperative retention plan for serial titles. The current three year Regional Medical Library (RML) Program (1983-85) funded by NLM called for cooperative collection development activities, but not for preservation per se. Planning for the next three to five year period places increased emphasis on preservation.

The Library Operations (LO) five year plan calls for developing cooperative preservation activities among health science libraries, among libraries with collections in the history of medicine and among the three national libraries. Ongoing discussions with the Library of Congress and the National Agricultural Library intended to reduce duplication of effort by more clearly defining the three institution's areas of responsibility for acquisition and bibliographic control of material should be broadened to include other service responsibilities including preservation. Cooperative efforts are essential as federal deficits and pressures to decrease expenditures in the non-defense sector are likely to result in increased competition among government agencies for available dollars. Within NLM the preservation program will face tough competition from other high priority programs.

In 1984 the arena of cooperative preservation activities is large and diverse. There is no monolithic national plan, but a sometimes confusing diversity. The task before NLM is to become better acquainted with existing and planned cooperative efforts and to provide the leaderhip necessary for an effective national program for preservation of the biomedical literature.

E. PLANNING METHODOLOGY

BASIC ASSUMPTIONS

The Act creating the National Library of Medicine gave the Library responsibility for the preservation of the biomedical literature. Drawing on the responses to a Delphi instrument on scope and coverage issues recently completed by many NLM staff, the RML Directors and Associate Directors, and a few contact people identified by the MLA/NLM Liaison Committee, the Preservation Planning Team has developed the following interpretation of NLM's Preservation mission:

1. NLM has responsibility to ensure that substantive biomedical literature is preserved, but need not do all the preservation work itself. Its preservation efforts should be coordinated with those of other national libraries, research libraries and biomedical libraries.

2. NLM has preservation responsibility for literature in all formats (e.g., printed, audiovisual, machine readable) and its preservation plan should reflect this. As described

previously, the following types of materials are represented in the NLM collection now and should be addressed in the Plan:

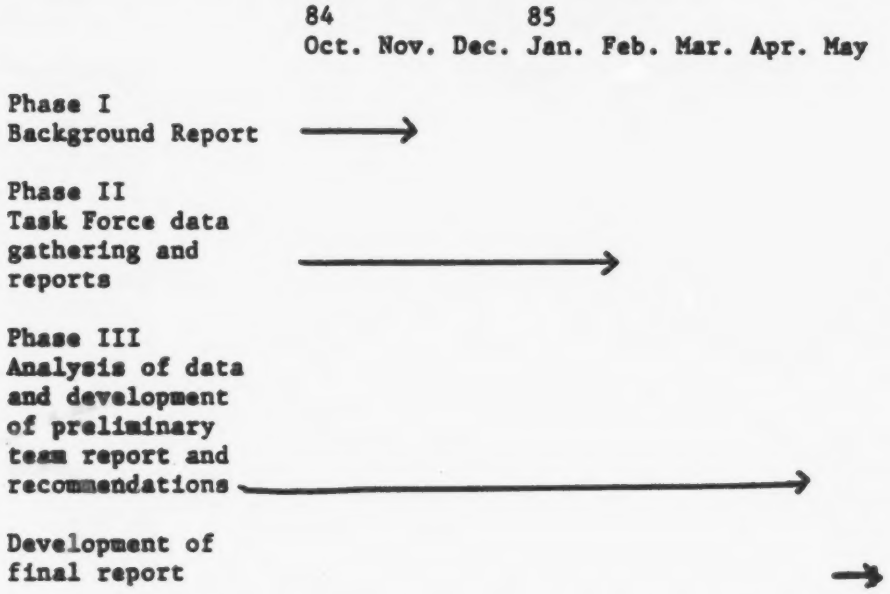
- Printed literature
- Manuscripts
- Pictures
- Microforms
- Videotapes and Audiotapes
- Slides and Filmstrips
- Motion Picture Films
- Computer tapes and discs
- Videodiscs

3. NLM's primary preservation responsibility is for the content of the biomedical literature rather than its original format. The need to preserve the original format as well as the content of the literature varies depending on the nature of the literature. In some cases it may be necessary to destroy the original format in order to preserve the content in a cost-effective and usable manner.

This view of NLM's preservation responsibility will govern the development of the plan.

SCHEDULE

The timetable for development of the Preservation Plan is as follows:



The distribution of this background report marks the conclusion of Phase I.

TASK FORCE CHARGES AND MEMBERS

During the next phase of the preservation planning process, separate task forces will gather information and develop recommendations in the following six areas:

1. Physical condition of the collection.

2. Conditions under which the collection is stored, processed, and used.

3. Organizational responsibility for preservation activities.

4. Available preservation techniques/methods.

5. Cooperative preservation activities appropriate for NLM.

6. Disaster recovery planning.

Each Task Force will contain staff from a variety of LO and NLM components; most of the Task Forces will be headed by a member of the Preservation Planning Team.

Although each Task Force has its own specific charge, the general purpose of all six groups is to provide the Preservation Planning Team with background information and suggested courses of action which can be reviewed and considered in developing the NLM Preservation Plan. All Task Forces are expected to use applicable standards and guidelines and to build on any relevant data collection activities undertaken at NLM in the past.

Each Task Force will begin work on November 26, 1984, and will submit its report to the Team by February 15, 1985. During this same period, the Team will develop draft guidelines for selecting items to be preserved and assigning preservation priorities. In early February, there will be a combined meeting of all the Task Forces in which each will present a summary of its findings and recommendations. After this meeting, the Team will analyze all the reports and begin work on the overall Preservation Plan. The tentative deadline for completion of the Plan is May 30, 1985.

1. Physical Condition of the Collection

The purpose of this Task Force is to:

1. Determine methods for assessing the condition of a variety of types of material in the NLM collection. This includes identification of:
    - * sampling techniques
    - * elements of the material to be examined
    - * criteria for determining degree of deterioration
2. Assess the condition of each type of material.
3. Produce an inventory of the general state of each type of material.
4. Identify specific problem areas (i.e., materials in deteriorated condition) by category, e.g., date range, country of origin.
5. Rank problems, based on the physical condition of the materials.

Chair: Jim Cain, RSD, LO

Members: John Horne, RSD, LO
Alice Ladson, RSD, LO
Alex Nobleman, RSD, LO
Young Rhee, HMD, LO
Carol Spencer, LO
Carol Unger, RSD, LO

2. Environmental Conditions for the Collection

The purpose of this Task Force is to:

1. Produce an inventory of current environmental conditions in which the collections are stored or displayed. This activity includes:

    * determination of the specific conditions (e.g., temperature, humidity, light, air quality, physical structures for storing the material) to be evaluated

    * identification of the various locations to be monitored

    * collection and summarization of environmental data

2. Compare NLM's environmental conditions and use practices with generally accepted standards and the practices of other institutions with effective preservation programs.

3. Identify any specific problems with NLM's environmental conditions, including any which contribute to the possibility of disaster or are likely to hamper responses to disaster.

4. Identify methods for correcting any problems, including consideration of off site storage, and give the pros and cons and costs of each.

5. Recommend actions to be taken to correct or avoid the problems.

Chair: Mark Rotariu, OFM, OA

Members: Doralee Agavoff, RSD, LO
Herbert ~~Kroger,~~ NIH
Jay McNeave, RSD, LO
Karen Patrias, RSD, LO
Patricia Ruben, OAMS, OA
Norman Smith, LO

3. **Processing and Use Practices**

The purpose of this Task Force is to:

1. Describe current processing and use (including security considerations) of the collection as they affect the condition of the material. This activity includes:

   - identification of types of use, use policies and their effects on the collection.

   - identification of types of processing (e.g., labeling, shelving, binding, filming, mailing, reproduction) and processing policies and their effects on the collection.

   - identification of equipment used for processing, viewing, or reproducing materials and their effects on the collection.

2. Compare NLM's use and processing practices with generally accepted standards and the practices of other institutions with effective preservation programs.

3. Identify any specific problems with NLM's use and processing activities, including any which contribute to the possibility of disaster or are likely to hamper responses to disaster.

4. Identify methods for correcting any problems and give the pros and cons and costs of each.

5. Recommend actions to be taken to correct or avoid problems.

Chair: Linda Watson, RSD, LO

Members: Kevin Beverly, RSD, LO
Rosellen Muniak, TSD, LO
Eileen Murtagh, TSD, LO
Nancy Selinger, BSD, LO
Manfred Waserman, HMD, LO

4. **Preservation Techniques/Methods**

The purpose of this Task Force is to:

1. Inventory and compare available preservation techniques and methods for the various types of material in the collection, with emphasis on deacidification, mass disc storage, microfilm, film preservation, and acquisition of materials in archival formats. Information gathered on each method should include:

   - material for which it is suitable
   - pros and cons of its use including:
     effect on public service and staff activities,
     longevity
     potential adverse effects on users, staff, or material
     resistance to disaster
     historical experience with technique
     industry support for technology
   - cost - initial and ongoing
   - impact on implementation schedule

2. Evaluate the most promising methods as to their suitability for use at NLM, either for retrospective or prospective collections.

3. Make recommendations on methods which should be used or evaluated further by NLM.

Chair: John Parascandola, HMD, LO

Members: George Cosmides, SIS
Peter Krivatsy, HMD, LO
Dianne McCutcheon, TSD, LO
Sarah Richards, RSD, LO
George Thoma, LHC
Philip Tiegan, HMD, LO

5. **Organizational Responsibility for Preservation Activities**

The purpose of this Task Force is to:

1. **Develop an inventory of current NLM preservation activities which includes:**
   - **organizational component(s) involved**
   - **number and kind of FTEs involved**
   - **current budget for the activity**
2. **Examine the organization of preservation activities in other organizations with effective preservation programs.**
3. **Identify any problems with the organization of preservation activities at NLM.**
4. **Recommend any changes to the organization of preservation activities at NLM, including summarizing the qualifications for and duties of any new positions needed.**

Chair: Betsy Humphreys, LO

Members: James Cassedy, HMD, LO
Judith Duff, LO
Lillian Kozuma, LO
Jacque-Lynne Schulman, RSD, LO
Sheldon Kotzin, BSD, LO, Consultant

6. Cooperative Preservation Activities

The purpose of this Task Force is to:

1. Identify existing cooperative activities which could assist NLM in fulfilling its preservation mission, including any in which NLM already participates.

2. Identify any new cooperative activities needed to fulfill this mission.

3. Assess the advantages and disadvantages, and probable cost of each.

4. Make recommendations for NLM leadership of and/or participation in cooperative activities.

Chair: Duane Arenales, TSD, LO

Members: Jeanne Brand, EP
Martha Fishel, TSD, LO
Becky Lyon-Hartmann, RML, LO
Scott Plutchak, BSD, LO

7. Disaster Recovery Task Force

The purpose of this Task Force is to:

1. Review and evaluate NLM's current Disaster Recovery Plan to ensure that it:

   * covers adequately all types of materials in the NLM collection

   * deals with the effects of the various kinds of disasters which are most likely to befall the NLM collection

   * compares favorably with good examples of Disaster Recovery Plans prepared by other institutions

2. Make any necessary changes to the Disaster Recovery Plan.

Chair: Carol Ditzler, RSD, LO

Members: Norman Smith, LO
Ione Auston, RSD, LO

Appendix 2

List of Task Force Members

1. Physical Condition of the Collection

Chair: Jim Cain, RSD, LO

Members: John Horne, RSD, LO
Alice Ladson, RSD, LO
Alex Nobleman, RSD, LO
Young Rhee, HMD, LO
Carol Spencer, LO
Carol Unger, RSD, LO

2. Environmental Conditions for the Collection

Chair: Mark Rotariu, OFM, OA

Members: Doralee Agayoff, RSD, LO
Herbert Crigger, NIH
Jay McNeave, RSD, LO
Karen Patrias, RSD, LO
Patricia Ruben, OAMS, OA
Norman Smith, LO

3. Processing and Use Practices

Chair: Linda Watson, RSD, LO

Members: Kevin Beverly, RSD, LO
Rosellen Muniak, TSD, LO
Eileen Murtagh, TSD, LO
Nancy Selinger, BSD, LO
Manfred Waserman, HMD, LO

4. Preservation Techniques/Methods

Chair: John Parascandola, HMD, LO

Members: George Cosmides, SIS
Peter Krivatsy, HMD, LO
Dianne McCutcheon, TSD, LO
Sarah Richards, RSD, LO
George Thoma, LHC
Philip Teigen, HMD, LO

5. **Organizational Responsibility for Preservation Activities**

Chair: Betsy Humphreys

Members: James Cassedy, HMD, LO
Judith Duff, LO
Lillian Kozuma, LO
Jacque-Lynne Schulman, RSD, LO
Sheldon Kotzin, BSD, LO

6. **Cooperative Preservation Activities**

Chair: Duane Arenales, TSD, LO

Members: Jeanne Brand, EP
Martha Fishel, TSD, LO
Becky Lyon-Hartmann, RML, LO
Scott Plutchak, BSD, LO

7. **Disaster Recovery Task Force**

Chair: Carol Ditzler, RSD, LO

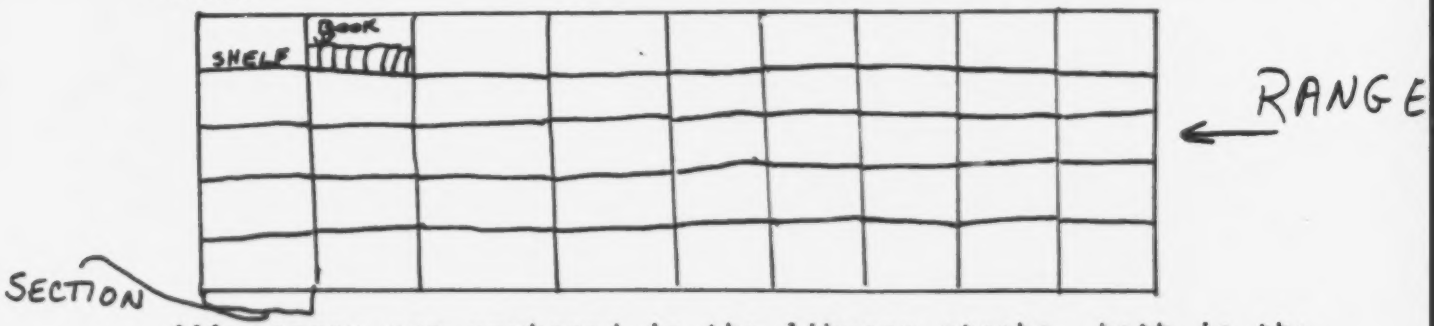
Members: Norman Smith, LO
Ione Auston, RSD, LO

Appendix 3

Procedures Used in the Survey of the Physical Condition of the Collection

PHYSICAL CONDITION SURVEY

The books you are to examine in the stacks have been preselected at random. Your tally sheet indicates which range, section, shelf, and book you are to look at. Here is a diagram which explains what is meant by the terms: range, section, shelf and book.



All ranges are numbered in the library stacks, both in the General Collection (A, B, and C levels) and in the History of Medicine Division. A double range has only one number, so for ease in this project, they are subdivided into "A" and "B" halves. "A" is the side to the North or closest to HMD in the General Collection.

The number of the Section is counted from the aisle. Count sections from left to right as you are facing the section. This will ensure that the same section is reached no matter what aisle you may enter the section from.

Count shelves from top to bottom. Count books from left to right. If there is no book that matches the one you are supposed to pull, place a large "X" in the call number area of the tally sheet. When you pull the book you are to examine, first write down the call number with volume and year information. Be as complete as necessary to identify the specific volume. You may shorten the title.

Examine the book and enter your results following the "Instructions for Examining Paper Media for Physical Condition".

INSTRUCTIONS FOR EXAMINING PAPER MEDIA FOR PHYSICAL CONDITION

A survey of selected titles will be performed to collect data on their physical condition. Volumes to be examined will be randomly selected. The information on the worksheet will lead you to the specific volume to test.

There are two components to the physical condition to be recorded. The first is the fold test for brittleness of paper. The second is the state of the binding and overall condition of the piece.

The fold test is conducted in the following manner. A random page of the volume (chosen from the midpart of the book, not the first or last few pages) is selected and the upper corner tested. Fold, without creasing, the corner forward 135 degrees (almost all the way down), then fold it back in the opposite direction approximately 270 degrees (almost all the way down in the opposite direction), then bring it forward approximately 135 degrees to its original postition. Do not crease. This three-step procedure constitutes "one fold" if the corner remains attached to the page. If the corner breaks off during the first test, it is in "zero fold" condition. If it completes one full test, and breaks during the second, it is in "one fold" condition, etc. . . . Record the number of completed folds. Do not test further than 10 folds.

The condition of the binding and pages will fit into one of the following categories. Record the letter code which best describes the book you are examining.

A. Good binding, no loose pages.
B. Text block intact, sewing tight, but loose from binding.
C. Text block intact, sewing tight but out of binding.
D. Textblock intact, sewing tight, binding badly damaged, red rot, etc.
E. Good binding, but torn pages.
F. Unbound issue.
G. Text blockintact,but loose from binding andtorn pages.
H. Text block intact, but out of binding and torn pages.
I. Text block intact, but binding damaged and torn pages.
J. Unbound issue with torn pages.
K. Environmental damage, including insects, water, mold, etc. (Give these to Carol Unger immediately after recording so that further damage or contaminatation can be prevented.)
L. Bound, text block and sewing coming apart.

Condition Grades for Manuscript Materials

A. Container and Manuscripts in good condition.

B. Container damage, including torn boxes and folders.

C. Manuscripts have frayed edges or tears.

D. Container damage, and manuscripts have frayed edges or tears.

E. Manuscripts have rusting metal clips, staples, etc. present.

F. Container damage, and manuscripts havd rusting metal clips, staples, etc, present.

G. Manuscripts have frayed edges or tears, and rusting metal clips, staples, etc. are present.

H. Container damage, and manuscripts have frayed edges and tears, and rusting metal clips, staples, etc. are present.

I. Manuscripts are badly yellowed and/or foxed (over 30% of item).

J. Enviromental damage to manuscripts, including insects, water, mold, etc.

Summary Categories for Physical Condition

Bound Paper Media

A = Good

B,C,D,L = Binding Damaged

E,G,H,I = Pages Torn

F,J = Unbound

K = Environmental Damage

Unbound Manuscripts

A = Good

B,C,D,E,F = Moderate

G,H,I,J = Poor/Environmental Damage

INSTRUCTIONS FOR SAMPLING 16MM FILM FOR PHYSICAL CONDITION

There are eight (8) components to the physical condition to be recorded. The material to be examined will be randomly selected. The information on the worksheet will lead you to the specific item to be examined. The conditions should fit into one of the following categories. Record the letter code which best describes the item being examined.

COMPONENT		DESCRIPTION
1	A)	GOOD - No splices or obvious scratches, or pulled sprockets
	B)	FAIR - Maximum of four (4) splices, and minimal scratching
	C)	POOR - Excess of four (4) splices, heavily scratched
	D)	SHRUNKEN - Distance between sprockets shortened, (use guage)
	E)	BRITTLE - Use end fold test (maximum of 10 folds of 180°)
	F)	MISSING - Not on shelf
2	A)	NORMAL COLOR - Realistic flesh color or recognizable item color
	B)	OFF-COLOR - Unrealistic flesh color (Blue, green, etc.) of recognizable item color
	C)	FADED OVERALL - Everything same color
3	A)	GOOD - Clear, sharp, black & white images
	B)	POOR - "Washed-out" images or extremely dark images
4	A)	GOOD - Clear, distinct voice sounds
	B)	DISTORTED - Garbled voice sounds
	C)	N/A - Not applicable (slient)
5	A)	COMPLETE - Correct number films (Part I, Part II, etc.)
	B)	INCOMPLETE - Missing film parts from the title
	C)	MISSING - Not on shelf
6	A)	GOOD - Beeper in place and no adhesive leakage
	B)	OOZING - Beeper in place but adhesive leaking
	C)	MISSING - No Beeper applied or was removed
7	A)	GOOD - Label in place, legible
	B)	POOR - Label defaced, illegible
	C)	MISSING - No label visible

8

A) GOOD - Binding tight, no loose or missing pages
B) POOR - Binding loose, torn and pages missing
C) BRITTLE - Apply print media fold test (10 fold limitation)
D) MISSING - Not with film
E) N/A - Not applicable

INSTRUCTIONS FOR SAMPLING SLIDES & SLIDE/TAPES FOR PHYSICAL CONDITION

There are nine(9) components to the physical condition to be recorded. The material to be examined will be randomly selected. The information work sheet will lead you to the specific item to be examined.

The conditions of the sample should fit into one of the following categories. Record the letter code which best describes the item being examined.

COMPONENT	DESCRIPTION
1	A) GOOD - no physical damage visible D) MISSING - not in kit
2	A) NORMAL COLOR - Realistic flesh color or recognizable item color B) OFF-COLOR - unrealistic flesh color (Blue, green, etc.) or recognizable item color C) FADED OVERALL - Everything same color
3	A) GOOD - No apparent damage visible N/A - Not applicable
4	(Self-explanatory) N/A - Not applicable
5	A) GOOD - Clear distinct voice sound B) DISTORTED - Garbled voice sound C) NO AUDIO - No voice sound recorded D) MISSING - No cassette/s E) N/A - Not applicable
6	A) GOOD - No tears or separation of binder B) FAIR - Clasp does not hold, otherwise binder is all right C) MISSING - Not on shelf
7	A) GOOD - Beeper in place, no adhesive leakage B) OOZING - Beeper in place, adhesive leakage C) MISSING - No beeper applied or was removed
8	A) GOOD - No label adhesive leekage or smearing B) OOZING - Label adhesive leaking, smearing C) MISSING - No label visible
9	A) GOOD - No torn or missing pages B) POOR - Torn and missing pages C) BRITTLE - Apply print media fold test, (10 fold limitation) D) MISSING - Not with cassette/s E) N/A - Not applicable

INSTRUCTIONS FOR SAMPLING FILM STRIPS FOR PHYSICAL CONDITION

There are ten (10) components to the physical condition to be recorded. The material to be examined will be randomly selected. The information worksheet will lead you to the specific item to be examined. The conditions of the sample should fit into one of the following categories. Record the letter code which best describes the item being examined.

COMPONENT	DESCRIPTION
1	A) GOOD - No obviously torn or pulled sprocket holes or scratches B) FAIR - Some pulled sprocket holes, minimal scratches C) POOR - Badly pulled sprocket holes, deeply scratched, and/or multiple splices
2	A) GOOD - Normal flesh color or recognizable item color B) OFF-COLOR - Unrealistic flesh color (green faces, etc.), or recognizable item color C) FADED OVERALL - Everything same color
3	A) GOOD - No physical damage visible B) N/A - Not applicable, not required
4	(Self-explanatory) N/A - Not applicable
5	A) GOOD - Clear, distinct voice sound B) DISTORTED - Garbled voice sound C) NO AUDIO - No voice sound recorded D) MISSING - No cassette E) N/A - Not applicable
6	A) COMPLETE - Correct number of film strips/cassettes in kit B) INCOMPLETE - Film strips/cassettes missing from kit C) MISSING - Not on shelf
7	A) GOOD - No tears of separation of binder B) FAIR - Clasp does not hold or close properly, otherwise it is alright C) MISSING - Not on shelf
8	A) GOOD - Beeper in place, no adhesive leakage B) OOZING - Beeper in place, adhesive leakage C) MISSING - No beeper applied or was removed

A) GOOD - No label adhesive leakage or smearing
9 B) OOZING - Label adhesive leaking, smearing
C) MISSING - No label visible

A) GOOD - Binding tight, no torn, loose, or missing pages
B) POOR - Binding loose, torn and missing pages
10 C) BRITTLE - Apply print media fold test (10 fold limitation)
D) MISSING - Not with kit
E) N/A - Not applicable

INSTRUCTIONS FOR SAMPLING VIDEO TAPE CASSETTES FOR PHYSICAL CONDITION

There are eleven (11) components to the physical condition to be recorded. The material to be examined will be randomly selected. The information worksheet will lead you to the specific item to be examined. The conditions of the sample should fit into one of the cateogries. Record the letter code which best describes the item being examined.

COMPONENT	DESCRIPTION
1	A) GOOD - No apparent damage visible B) DAMAGED - Cracked, screws missing C) MISSING - Not on shelf
2	A) NO - (Self explanatory) B) YES - Note number of video dropouts
3	A) NO - (Self explanatory) B) YES - Note number of audio dropouts
4	A) GOOD - Cassette tape runs smoothly B) ERRATIC - Cassette tape runs noisily C) JAMMED - Cassette tape locked will run
5	A) NORMAL - Realistic flesh color are recognizable item color B) OFF-COLOR - (green faces, etc.)
6	A) NORMAL - Clear, sharp images B) POOR - Weak, washed-out images
7	A) COMPLETE - Correct number of films in kit B) INCOMPLETE - Films and/or cassettes missing from kit C) MISSING - Not on shelf
8	A) GOOD - No tears or separation of binder B) FAIR - Binder does not close properly, otherwise binder is allright C) MISSING - Not on shelf
9	A) GOOD - Beeper in place, no adhesive leakage B) OOZING - Beeper in place, adhesive leakage C) MISSING - No beeper applied or was removed
10	A) GOOD - No label adhesive leakage or smearing B) OOZING - Label adhesive leaking, smearing C) MISSING - No label visible
11	A) GOOD - Binding tight, no loose or missing pages B) POOR - Binding loose, torn, and pages missing C) BRITTLE - Apply print media fold test (10 fold limitation) D) MISSING - Not with video cassettes E) N/A - Not applicable (not provided)

INSTRUCTIONS FOR SAMPLING AUDIO TAPE CASSETTES FOR PHYSICAL CONDITION

There are eight (8) components to the physical condition to be recorded. The material to be examined will be randomly selected. The information on the worksheet will lead you to the specific item to be examined.

The conditions should fit into one of the following cateogries. Record the letter code which best describes the item being examined.

COMPONENT	DESCRIPTION
1	A) GOOD - No apparant damage visible B) CRACKED/WARPED - Cassette shows apparent damage C) MISSING - Not on shelf
2	A) GOOD - Cassette tape runs smoothly B) ERRATIC - Cassette tape drags C) JAMMED - Cassette tape locked will not run
3	A) GOOD - Clear distinct voice sound B) DISTORTED - Garbled voice sound C) NO AUDIO - No voice sound recorded (blank) D) MISSING - Not on shelf
4	A) COMPLETE - Correct number of cassettes in kit B) INCOMPLETE - Cassettes missing from kit C) MISSING - Not on shelf
5	A) GOOD - No visible damage B) FAIR - Torn, or fails to close properly C) MISSING - Not on shelf D) N/A - Binder not supplied
6	A) GOOD - Beeper in place and no adhesive leakage B) OOZING - Beeper in place but adhesive leaking C) MISSING - No beeper applied or was removed
7	A) GOOD - Label in place, no adhesive leakage B) OOZING - Label in place, adhesive leaking C) MISSING - No label visible
8	A) GOOD - Binding tight, no loose or missing pages B) POOR - Binding loose, torn and pages missing C) BRITTLE - Apply print media fold test, (10 fold limitation) D) MISSING - Not with cassette/s E) N/A - Not applicable

553-J-85

Indoor Pollutant Measurements of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Library of Medicine

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Introduction

Levels of atmospheric pollutants, specifically sulfur dioxide, nitrogen oxides, and ozone were measured at two locations inside building #38 of the National Library of Medicine between April 8 and April 15, 1985. The locations at which these species were monitored were a stack area on the B2 level and the southeast corner of the main reading area on the B1 level. Ozone also was measured in the photocopy room on the B1 level identified as room 1W-27.

Measurement Plan

Continuous monitoring analyzers were used to sample the air exiting the ventilation system for periods of at least 48 hours at each site. Ambient sulfur dioxide levels were measured with a pulsed fluorescent sulfur dioxide analyzer. Nitrogen oxides, as NOx (NO2 + NO), were measured with an oxides of nitrogen analyzer utilizing the photometric detection of chemiluminescent light resulting from the reaction of nitric oxide with ozone. Ambient ozone levels were measured with a microcoulomb ozone sensing instrument.

The signals generated by the three analyzers were continuously recorded on strip chart recorders.

The sampling probe for the nitrogen oxides and sulfur dioxide analyzers was located directly in the path of incoming air exiting the ventilation system at both sites. The sample inlet of the ozone analyzer on the B2 level was positioned to sample air away from the inlet vents. This was done for two reasons. First, to reduce the probability of loss of ozone due to the length of the sampling probe needed to reach the ventilation inlet vents located at ceiling level and second, to include in the sample air surrounding a nearby photocopy machine to determine whether ozone was being generated by the machine. On the B1 level it was possible to sample incoming air for ozone directly in front of a ventilation vent. Measurements of ozone made in the photocopy room were intended only to quantify any ozone produced by the photocopiers.

Calibrations

Calibrations of the sulfur dioxide and nitrogen oxides analyzers were performed on a daily basis with the use of permeation tubes. The permeation devices used in the calibrations were themselves calibrated at NBS. These devices produce low known concentrations of sulfur dioxide or nitrogen dioxide in air by placing the tube of interest in a stream of purified air flowing at a known rate and at a known temperature. The flow of diluent air passed over each tube was measured with a calibrated mass flow meter. The permeation rate of the tubes at the times of calibrations was estimated from the measured temperature dependence of the rate and the temperature at which they were used.

To assign an estimated uncertainty to the concentrations of the generated calibration mixtures, the variations in the measured instrument sensitivities were used. The observed variation of the sensitivity (signal/concentration) for both the sulfur dioxide and nitrogen oxides analyzers was about $\pm$ 10 percent relative over the entire monitoring period during which measurements were taken.

The ozone sensitivity of the ozone analyzer was determined at NBS using an ultraviolet adsorption instrument and a standard reference photometer instrument. The signal generated by the analyzer is linearly proportional to the oxidant content of the gas sampled, however its response can be affected by interfering substances common to pollutants present in the atmosphere. For example, sulfur dioxide can interfere thus reducing the ozone-caused signal. Though it is difficult to accurately quantitate ozone levels, the values recorded by the analyzer show relative differences in concentrations of ozone in the air sampled.

Data Presentation

The concentration levels found for sulfur dioxide, nitrogen oxides, and ozone are summarized in Tables 1-9. The concentrations are given in parts per billion (ppb) by mole. These values indicate the levels measured at the approximate times indicated, and are not hourly averages.

Figures 1-9 contain plots of the sulfur dioxide and nitrogen oxides data taken from Tables 1-9 respectively.

Figures 10 and 11 represent plots of ozone measured based on the appropiate data tables.

Daily temperature and relative humidity measurements were made at the library within the vicinity of the monitoring sites. These data are listed in Table 10.

Results: Nitrogen Oxides

With the major contribution of nitrogen oxides being that generated by the automobile engine, it can be expected that increases in levels would occur during high densities of traffic (e.g. a.m. and p.m. rush hours). Careful examination of several of the plots show an increase in levels which can be correlated with traffic patterns. For example, figure 1 shows a nitrogen oxides peak between the hours of 4:00 p.m. and 7:00 p.m., the evening rush hours.

Figure 6 shows a relatively large nitrogen oxides peak. The highest concentration recorded was 208 ppb and was measured in the main reading area on the B1 level. On this particular day, weather information obtained from the Washington National Airport indicated the wind direction as being from the south-southeast at 8 mph. This would correspond with an air movement across Wisconsin Avenue picking up quantities of "traffic gases" and moving them directly toward the library building. When the wind is from other directions, north or west, considerable dilution of the traffic gases from other major traffic arteries would occur and the maximum in the nitrogen oxides measurements during rush hour periods would be reduced or non-existent.

Results: Sulfur Dioxide

From the data obtained, the most significant amount of sulfur dioxide measured was from the inlet vent located on the B2 level on April 9, 1985. The wind direction during the day was from the west at 15 mph. Such a wind direction would carry effluent from the power plant on the grounds at NIH and conceivably could be the source of the increased sulfur dioxide.

In general, the maximum values measured on the B2 level are higher than the maximum measured on the B1 level. However, the background concentrations as indicated by the minimum levels are the same indicating that the source of the higher concentrations observed on the B2 level is probably external and does not originate within the B2 level or its associated ventilation system.

Results: Ozone

No significant amounts of ozone were detected on the B2 level except for a period of about 1 hour on April 9, 1985, peaking at about 11:30 a.m. At this time, the photocopy machine was in constant use. A sudden increase in ozone from 1 to 8 ppb occurred at that time.

Higher levels were recorded on the B1 level due to the greater accessibility to the inlet vent.

The Council of Government reported an air quality index of 30 for ozone on April 9, 35 on April 10, and 40 on April 11, 1985. Figure 10 represents ozone measured on April 11, 1985, during the day which the index was 40.

The most significant amount of ozone in the library was measured inside the photocopy room IW-27 which contained five photocopy machines that were in frequent use. Tables 6-9 contain concentrations measured of ozone determined in the photocopying room IW-27 (marked with an asterisk). Figure 11 depicts ozone levels measured inside room IW-27 during April 13, 1985. This figure shows that the ozone level increased at approximately 9:00 a.m. and decreased at approximately 5:00 p.m., which correlates with the opening and closing hours of the library.

Conclusions

The concentrations of the three pollutants measured and the variations noted follow the general pattern observed in a previous study [1] for a large building in which the ventilation system does not act as a scrubber or purifier. The minimum values for each pollutant are approximately the same as was found in the previous study. The character of the concentration changes during an extended sampling period, 24 hours, and the height of the daily maximums were not as comparable but the difference in nature of the locations of the building could easily explain the difference. A conclusion to be drawn from this data is that in this particular building the interior atmosphere will reflect almost without change the external atmosphere except in those areas where, in this case ozone, is being internally generated.

The characteristic odor of ozone detected along with the results obtained indicate that significant levels are being generated and accumulated within room IW-27 by the photocopy machines during times when the machines are in frequent use. It should be noted that greater accumulations of ozone within room IW-27 than those measured could result in a potential health hazzard [2] due to the low recommended "permissible exposure limits" established for ozone.

References

[1] Hughes, E., and Myers, R., **Measurement of the Concentration of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Archives Building,** NBSIR 83-2767 , Natl. Bureau of Standards, Gaithersburg, Md.

[2] Little, A., **NIOSH/OSHA Pocket Guide to Chemical Hazards,** Aug. 1980.

Measurements of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Library of Medicine

Table 1

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B2 level	4/8/85	1200	---	65	---
B2 level	4/8/85	1300	---	38	---
B2 level	4/8/85	1400	---	34	---
B2 level	4/8/85	1500	---	46	---
B2 level	4/8/85	1600	4	38	1
B2 level	4/8/85	1700	21	65	1
B2 level	4/8/85	1800	24	65	1
B2 level	4/8/85	1900	7	42	1
B2 level	4/8/85	2000	2	34	2
B2 level	4/8/85	2100	2	27	2
B2 level	4/8/85	2200	2	34	1
B2 level	4/8/85	2300	2	38	1
B2 level	4/8/85	2400	3	46	1
		Minimum	2	27	1
		Maximum	24	65	2

--- No measurements were made at this time.

Measurements of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Library of Medicine

Table 2

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B2 level	4/9/85	0100	3	46	1
B2 level	4/9/85	0200	2	38	1
B2 level	4/9/85	0300	2	27	2
B2 level	4/9/85	0400	2	27	2
B2 level	4/9/85	0500	1	27	1
B2 level	4/9/85	0600	1	27	1
B2 level	4/9/85	0700	2	27	1
B2 level	4/9/85	0800	2	30	2
B2 level	4/9/85	0900	4	34	1
B2 level	4/9/85	1000	36	57	1
B2 level	4/9/85	1100	---	49	1
B2 level	4/9/85	1200	7	42	2
B2 level	4/9/85	1300	---	57	1
B2 level	4/9/85	1400	12	49	2
B2 level	4/9/85	1500	22	53	1
B2 level	4/9/85	1600	22	34	1
B2 level	4/9/85	1700	22	46	1
B2 level	4/9/85	1800	47	42	1
B2 level	4/9/85	1900	36	65	1
B2 level	4/9/85	2000	49	65	1
B2 level	4/9/85	2100	44	57	1
B2 level	4/9/85	2200	30	57	1
B2 level	4/9/85	2300	26	53	1
B2 level	4/9/85	2400	32	49	1
		Minimum	1	27	1
		Maximum	49	65	2

--- No measurements were made at this time.

Measurements of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Library of Medicine

Table 3

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B2 level	4/10/85	0100	6	30	1
B2 level	4/10/85	0200	20	30	1
B2 level	4/10/85	0300	3	23	1
B2 level	4/10/85	0400	14	27	1
B2 level	4/10/85	0500	4	27	1
B2 level	4/10/85	0600	4	27	1
B2 level	4/10/85	0700	2	30	1
B2 level	4/10/85	0800	18	49	1
B2 level	4/10/85	0900	10	42	1
B2 level	4/10/85	1000	---	---	1
		Minimum	2	23	1
		Maximum	20	49	1

--- No measurements were made at this time.

Measurements of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Library of Medicine

Table 4

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B1 level	4/10/85	1500	---	---	11
B1 level	4/10/85	1600	3	59	14
B1 level	4/10/85	1700	2	43	13
B1 level	4/10/85	1800	2	37	14
B1 level	4/10/85	1900	3	37	10
B1 level	4/10/85	2000	5	46	2
B1 level	4/10/85	2100	5	59	2
B1 level	4/10/85	2200	5	43	4
B1 level	4/10/85	2300	3	37	6
B1 level	4/10/85	2400	2	34	7
		Minimum	2	34	2
		Maximum	5	59	14

--- No measurements were made at this time.

Measurements of Sulfur Dioxide, Nitrogen Oxides,
and Ozone in the National Library of Medicine

Table 5

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B1 level	4/11/85	0100	2	28	12
B1 level	4/11/85	0200	2	28	12
B1 level	4/11/85	0300	1	28	12
B1 level	4/11/85	0400	2	31	13
B1 level	4/11/85	0500	1	31	11
B1 level	4/11/85	0600	2	28	10
B1 level	4/11/85	0700	2	28	8
B1 level	4/11/85	0800	2	37	4
B1 level	4/11/85	0900	2	46	3
B1 level	4/11/85	1000	2	46	---
B1 level	4/11/85	1100	---	43	11
B1 level	4/11/85	1200	---	---	13
B1 level	4/11/85	1300	19	46	13
B1 level	4/11/85	1400	6	43	16
B1 level	4/11/85	1500	5	46	17
B1 level	4/11/85	1600	6	46	16
B1 level	4/11/85	1700	8	53	13
B1 level	4/11/85	1800	8	37	17
B1 level	4/11/85	1900	4	37	12
B1 level	4/11/85	2000	5	43	3
B1 level	4/11/85	2100	5	140	2
B1 level	4/11/85	2200	4	71	2
B1 level	4/11/85	2300	4	59	4
B1 level	4/11/85	2400	4	53	4
		Minimum	1	28	2
		Maximum	19	140	17

--- No measurements were made at this time.

Measurements of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Library of Medicine

Table 6

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B1 level	4/12/85	0100	4	40	2
B1 level	4/12/85	0200	4	46	2
B1 level	4/12/85	0300	3	81	1
B1 level	4/12/85	0400	3	155	2
B1 level	4/12/85	0500	2	177	2
B1 level	4/12/85	0600	4	152	2
B1 level	4/12/85	0700	4	180	2
B1 level	4/12/85	0800	6	208	2
B1 level	4/12/85	0900	11	130	2
B1 level	4/12/85	1000	15	93	2
B1 level	4/12/85	1100	11	71	3
B1 level	4/12/85	1200	9	53	5
B1 level	4/12/85	1300	---	---	7
B1 level	4/12/85	1400	---	---	40 #
B1 level	4/12/85	1500	3	34	29 #
B1 level	4/12/85	1600	2	31	27 #
B1 level	4/12/85	1700	3	31	40 #
B1 level	4/12/85	1800	4	46	52 #
B1 level	4/12/85	1900	4	56	8 #
B1 level	4/12/85	2000	3	53	6 #
B1 level	4/12/85	2100	11	56	5 #
B1 level	4/12/85	2200	6	50	6 #
B1 level	4/12/85	2300	8	34	7 #
B1 level	4/12/85	2400	4	31	9 #
		Minimum	2	31	1
		Maximum	15	208	52

--- No measurements were made at this time.

Ozone measurements were made in the photocopy room located in room IW-27.

Measurements of Sulfur Dioxide, Nitrogen Oxides,
and Ozone in the National Library of Medicine

Table 7

Concentrations listed are in parts per billion (ppb) by vole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B1 level	4/13/85	0100	2	28	10 #
B1 level	4/13/85	0200	2	25	10 #
B1 level	4/13/85	0300	2	28	8 #
B1 level	4/13/85	0400	3	34	3 #
B1 level	4/13/85	0500	2	30	3 #
B1 level	4/13/85	0600	2	46	4 #
B1 level	4/13/85	0700	3	46	4 #
B1 level	4/13/85	0800	4	43	5 #
B1 level	4/13/85	0900	2	31	9 #
B1 level	4/13/85	1000	2	31	26 #
B1 level	4/13/85	1100	2	31	29 #
B1 level	4/13/85	1200	2	34	54 #
B1 level	4/13/85	1300	2	28	38 #
B1 level	4/13/85	1400	2	34	48 #
B1 level	4/13/85	1500	2	37	62 #
B1 level	4/13/85	1600	2	34	60 #
B1 level	4/13/85	1700	2	31	53 #
B1 level	4/13/85	1800	1	31	14 #
B1 level	4/13/85	1900	1	34	12 #
B1 level	4/13/85	2000	1	31	12 #
B1 level	4/13/85	2100	1	31	10 #
B1 level	4/13/85	2200	1	28	11 #
B1 level	4/13/85	2300	0	28	8 #
B1 level	4/13/85	2400	0	28	7 #
		Minimum	0	25	3
		Maximum	4	50	62

--- No measurements were made at this time.

Ozone measurements were made in the photocopy room located in room IM-27.

Measurements of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Library of Medicine

Table 8

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B1 level	4/14/85	0100	1	25	7 *
B1 level	4/14/85	0200	3	25	5 *
B1 level	4/14/85	0300	3	25	4 *
B1 level	4/14/85	0400	4	25	3 *
B1 level	4/14/85	0500	5	25	2 *
B1 level	4/14/85	0600	6	25	2 *
B1 level	4/14/85	0700	6	31	2 *
B1 level	4/14/85	0800	7	31	2 *
B1 level	4/14/85	0900	7	31	2 *
B1 level	4/14/85	1000	6	31	3 *
B1 level	4/14/85	1100	6	34	3 *
B1 level	4/14/85	1200	6	31	5 *
B1 level	4/14/85	1300	3	28	10 *
B1 level	4/14/85	1400	2	28	10 *
B1 level	4/14/85	1500	2	25	10 *
B1 level	4/14/85	1600	2	25	10 *
B1 level	4/14/85	1700	2	25	10 *
B1 level	4/14/85	1800	2	25	9 *
B1 level	4/14/85	1900	2	28	9 *
B1 level	4/14/85	2000	2	28	8 *
B1 level	4/14/85	2100	2	40	5 *
B1 level	4/14/85	2200	2	43	4 *
B1 level	4/14/85	2300	1	34	5 *
B1 level	4/14/85	2400	2	31	4 *
		Minimum	1	25	2
		Maximum	7	43	10

--- No measurements were made at this time.

* Ozone measurements were made in the photocopy room located in room IM-27.

Measurements of Sulfur Dioxide, Nitrogen Oxides,
and Ozone in the National Library of Medicine

Table 9

Concentrations listed are in parts per billion (ppb) by mole.

Sampling site	Date	Time	Sulfur dioxide	Nitrogen oxides	Ozone
B1 level	4/15/85	0100	2	28	5 ‡
B1 level	4/15/85	0200	2	22	7 ‡
B1 level	4/15/85	0300	2	40	8 ‡
B1 level	4/15/85	0400	1	34	8 ‡
B1 level	4/15/85	0500	2	22	8 ‡
B1 level	4/15/85	0600	3	22	6 ‡
B1 level	4/15/85	0700	2	31	3 ‡
B1 level	4/15/85	0800	5	50	2 ‡
B1 level	4/15/85	0900	---	---	3 ‡
B1 level	4/15/85	1000	---	---	4 ‡
B1 level	4/15/85	1100	---	---	30 ‡
		Minimum	1	22	2
		Maximum	5	50	30

--- No measurements were made at this time.
‡ Ozone measurements were made in the photocopy room located in room IW-27.

Temperature and Relative Humidity Measurements

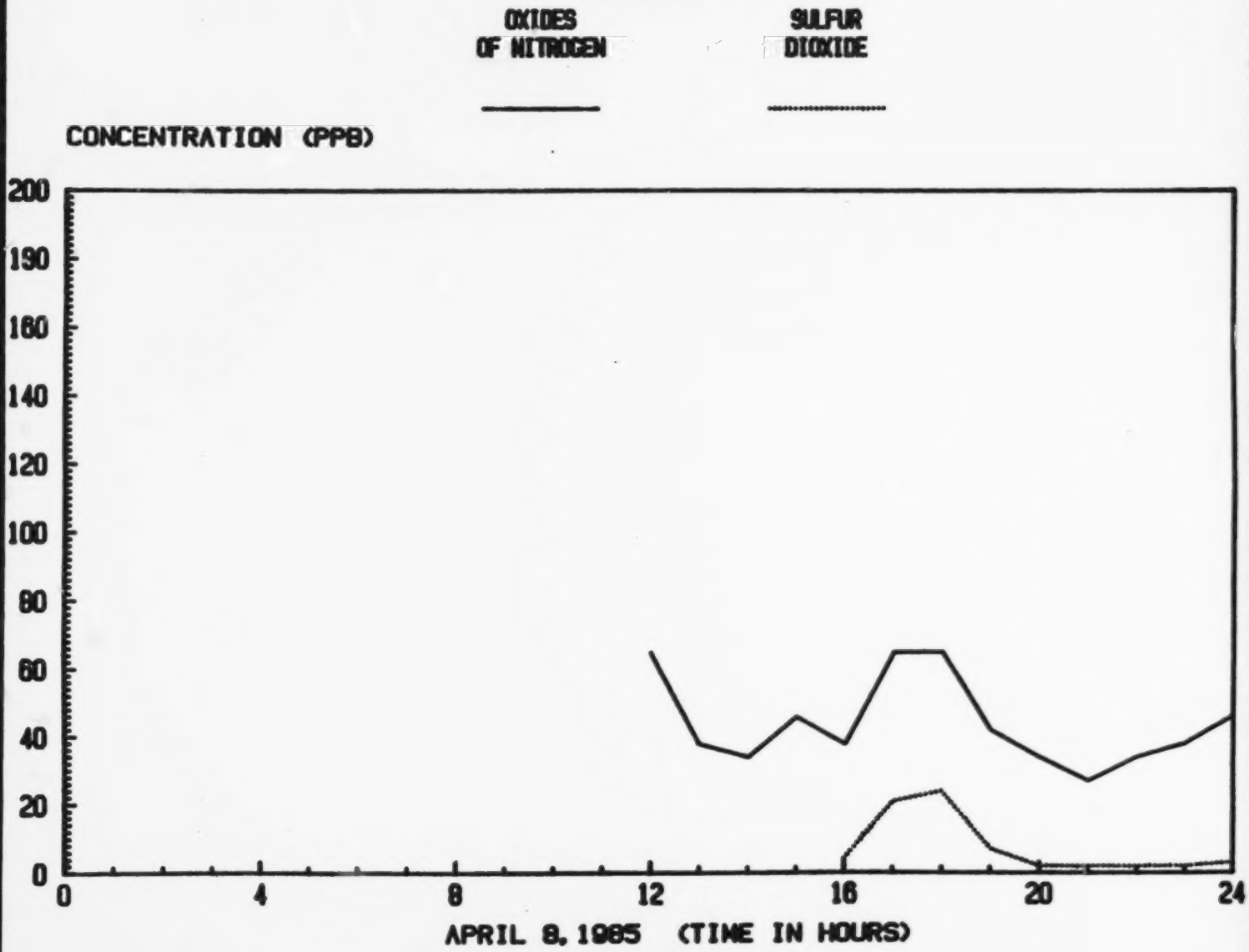
Table 10

Temperatures listed are in degrees celsius.

Sampling site	Date	Time	Temperature	Relative humidity
B2 level	4/08/85	1455	22.0	36 %
B2 level	4/09/85	0930	22.1	36 %
B2 level	4/09/85	1155	22.0	36 %
B2 level	4/10/85	1000	22.0	29 %
		Average temperature	22.0	
B1 level	4/10/85	1510	22.7	29 %
B1 level	4/11/85	1055	22.8	34 %
B1 level	4/12/85	1300	23.2	45 %
B1 level	4/15/85	1055	23.3	56 %
		Average temperature	23.0	

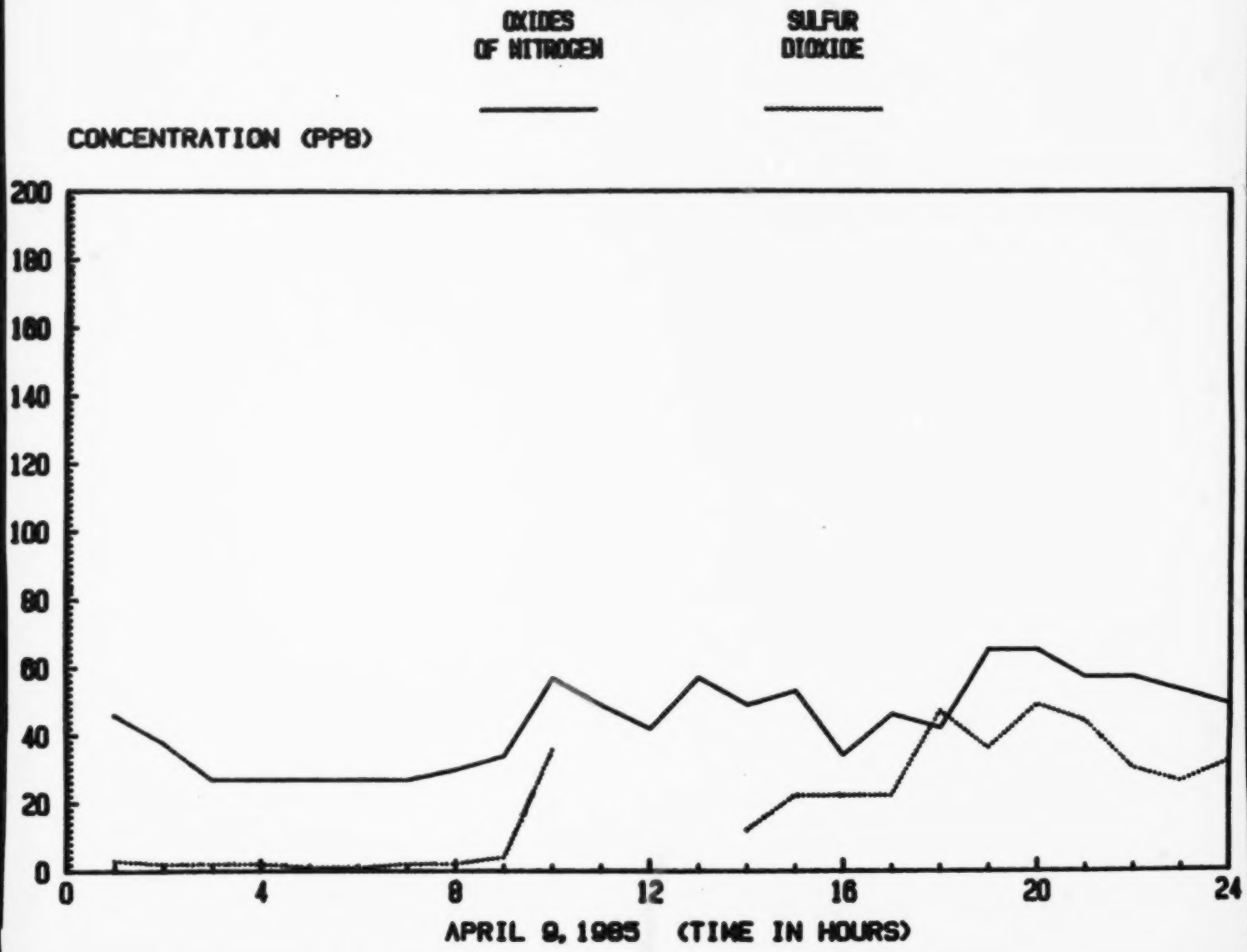
INDOOR POLLUTANT MEASUREMENTS

FIGURE 1.



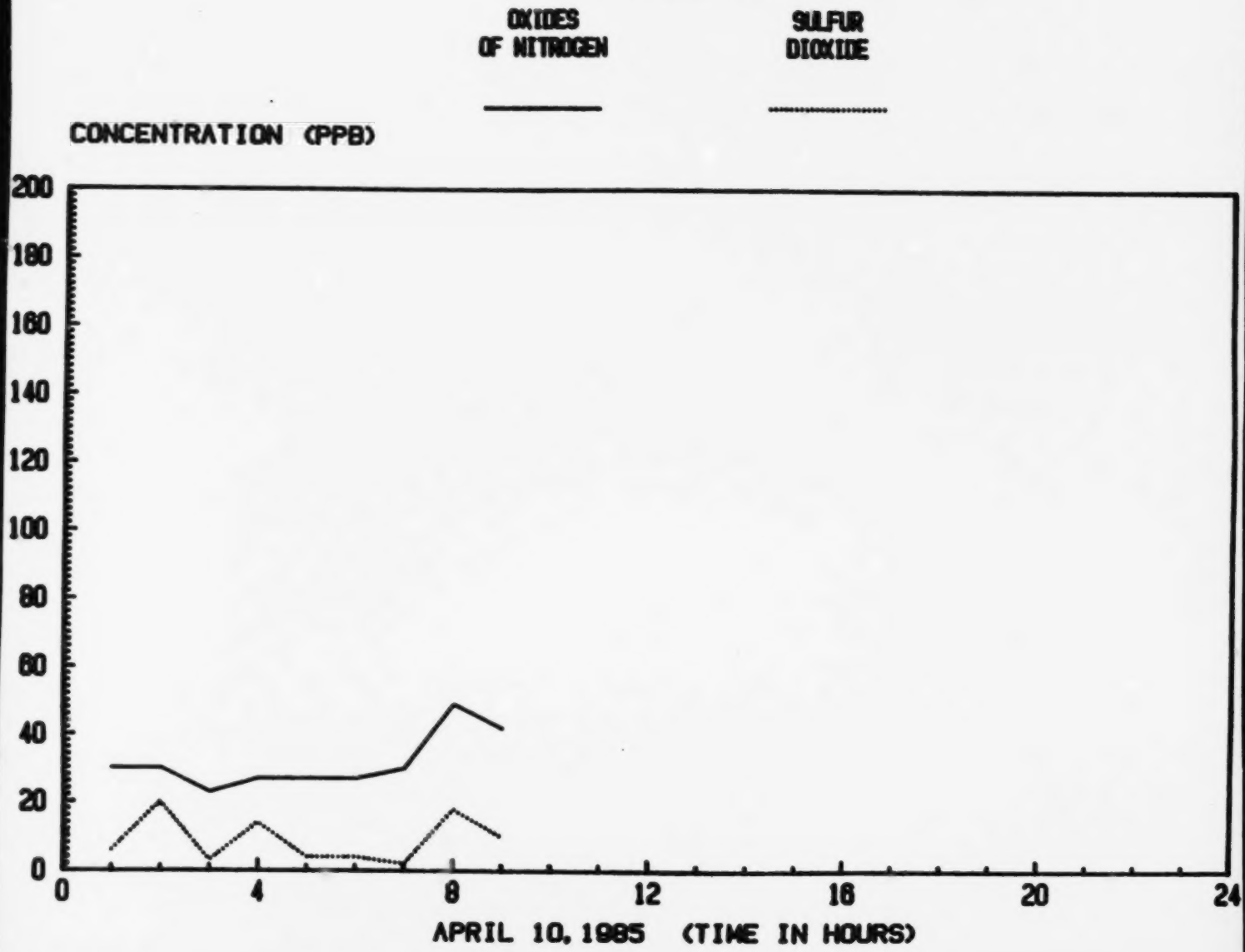
INDOOR POLLUTANT MEASUREMENTS

FIGURE 2.



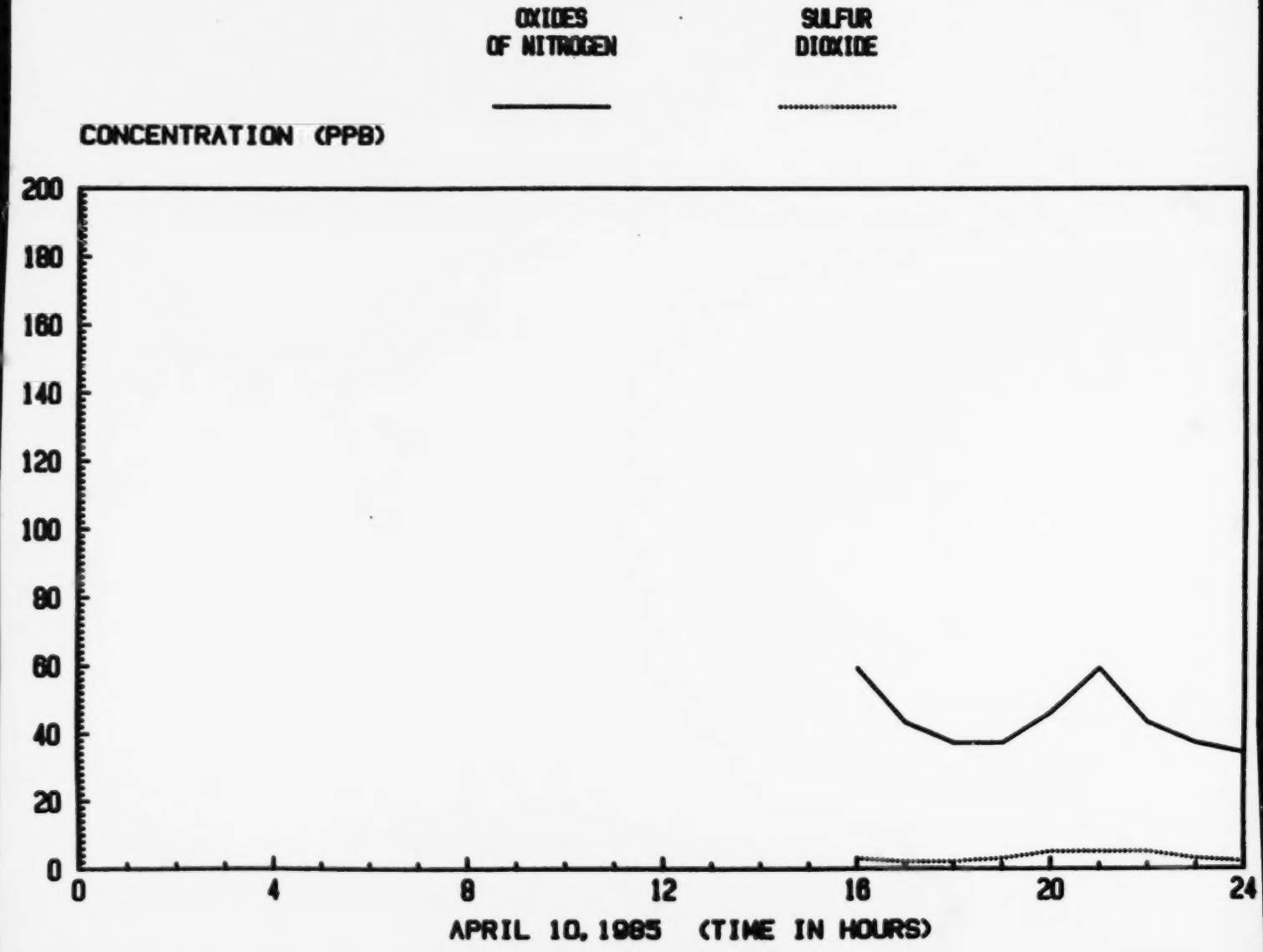
INDOOR POLLUTANT MEASUREMENTS

FIGURE 3.



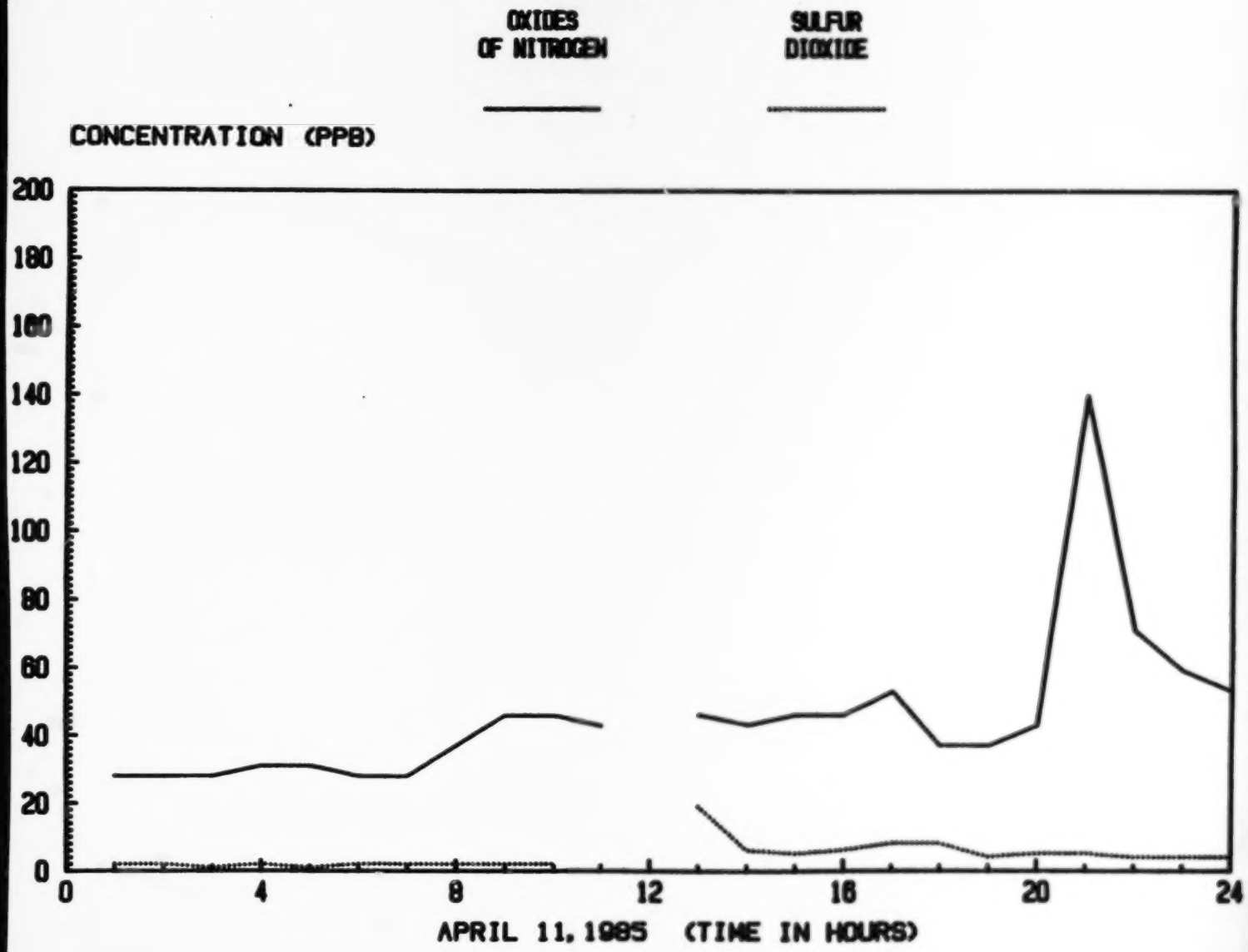
INDOOR POLLUTANT MEASUREMENTS

FIGURE 4.



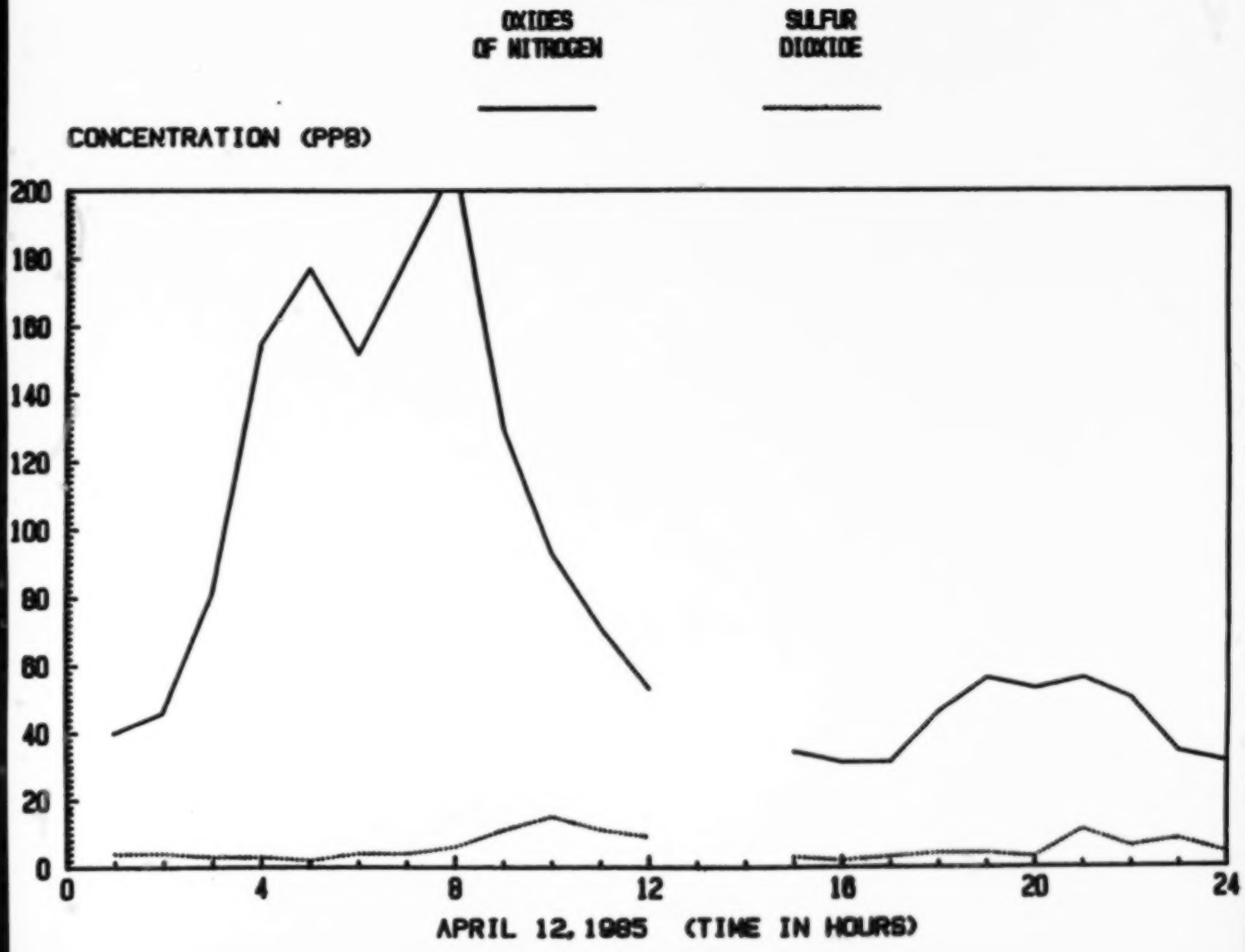
INDOOR POLLUTANT MEASUREMENTS

FIGURE 5.



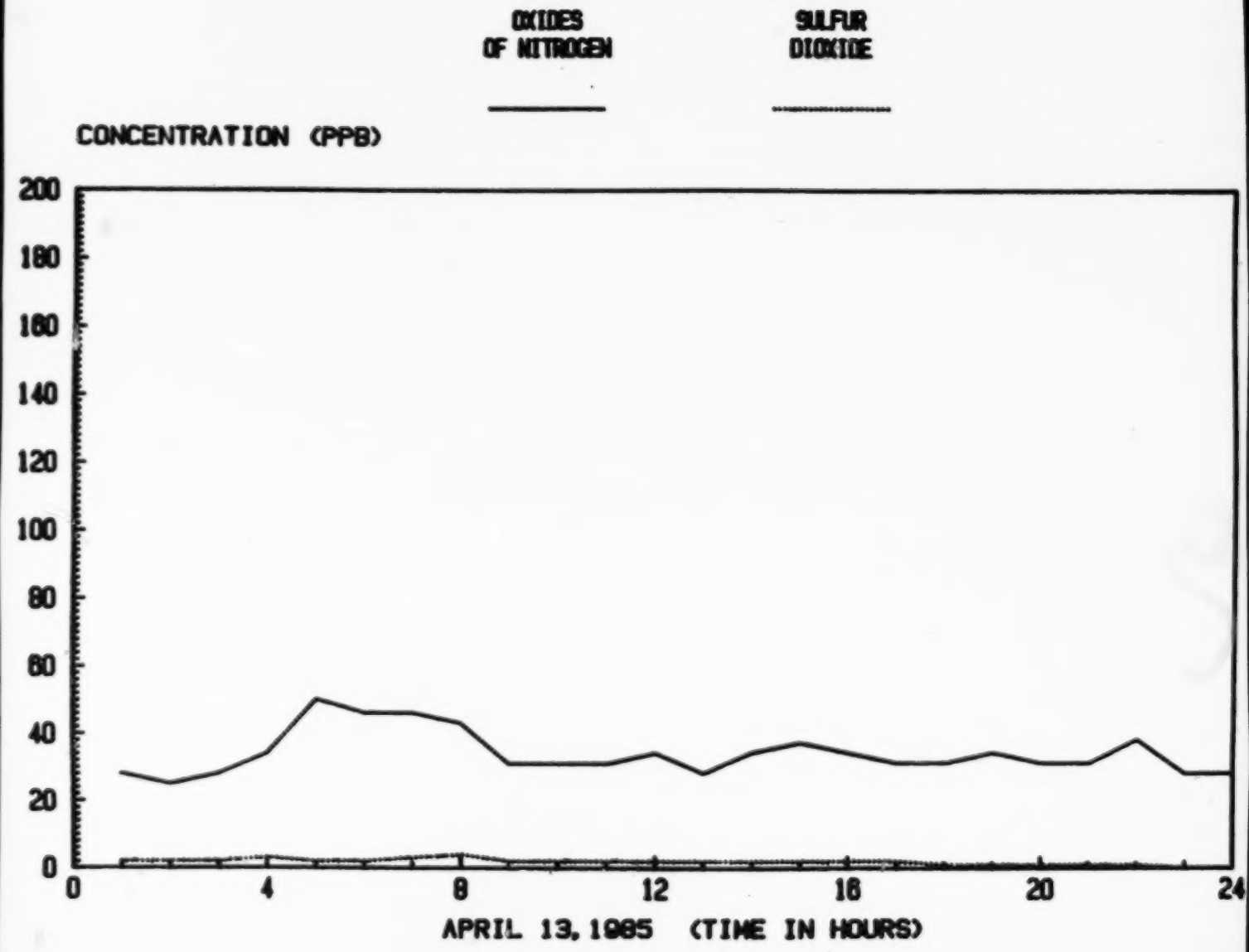
INDOOR POLLUTANT MEASUREMENTS

FIGURE 6.



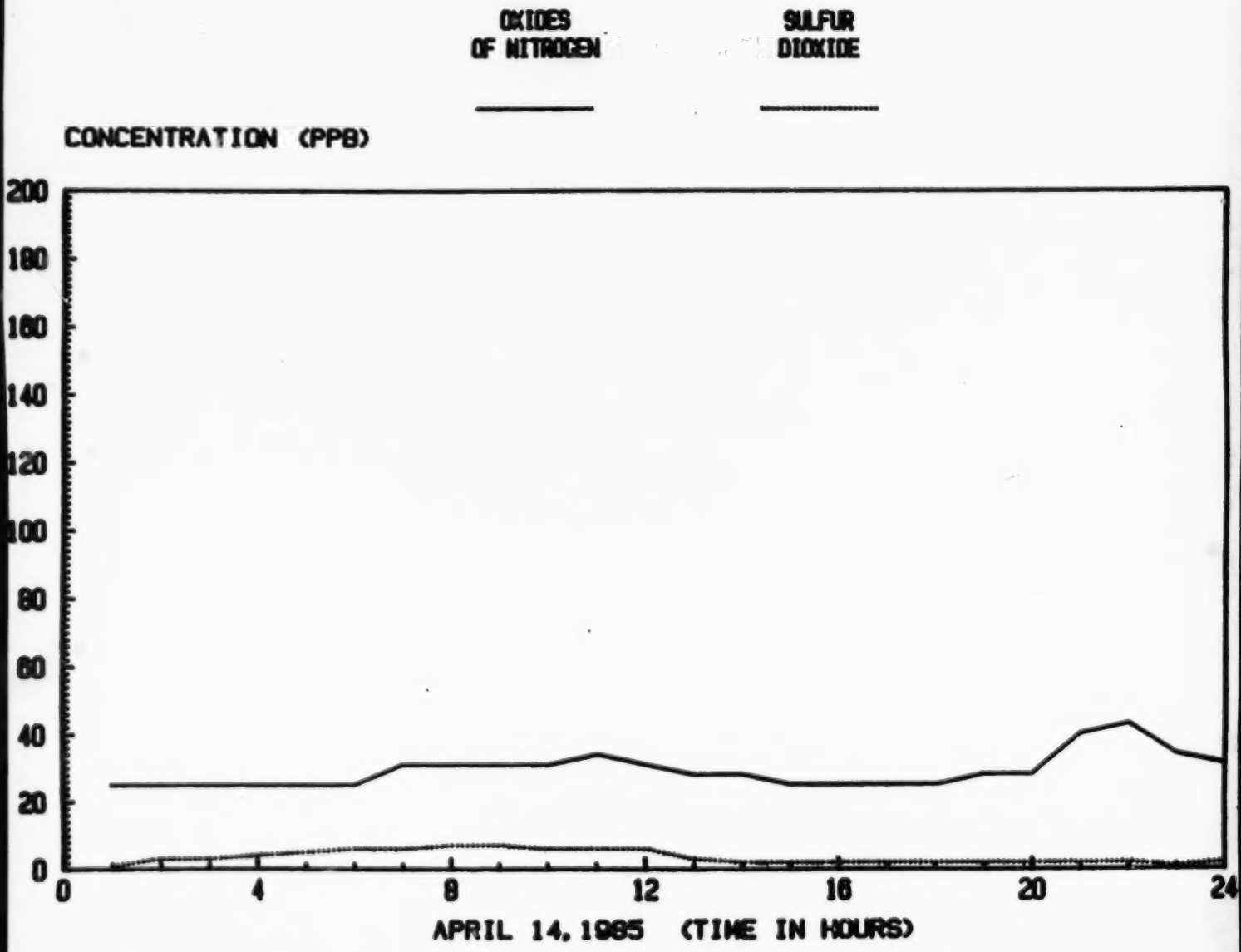
INDOOR POLLUTANT MEASUREMENTS

FIGURE 7.



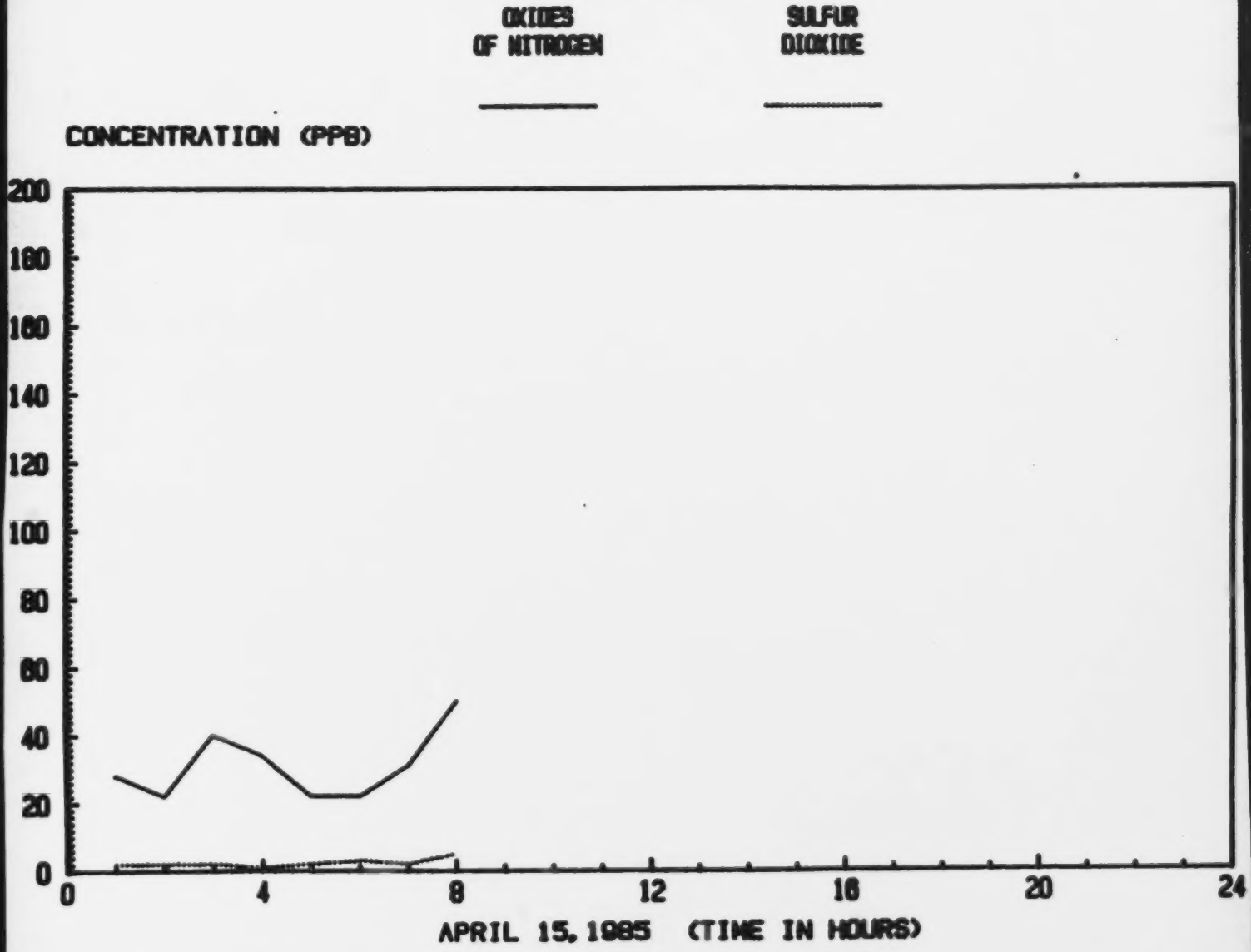
INDOOR POLLUTANT MEASUREMENTS

FIGURE 8.



INDOOR POLLUTANT MEASUREMENTS

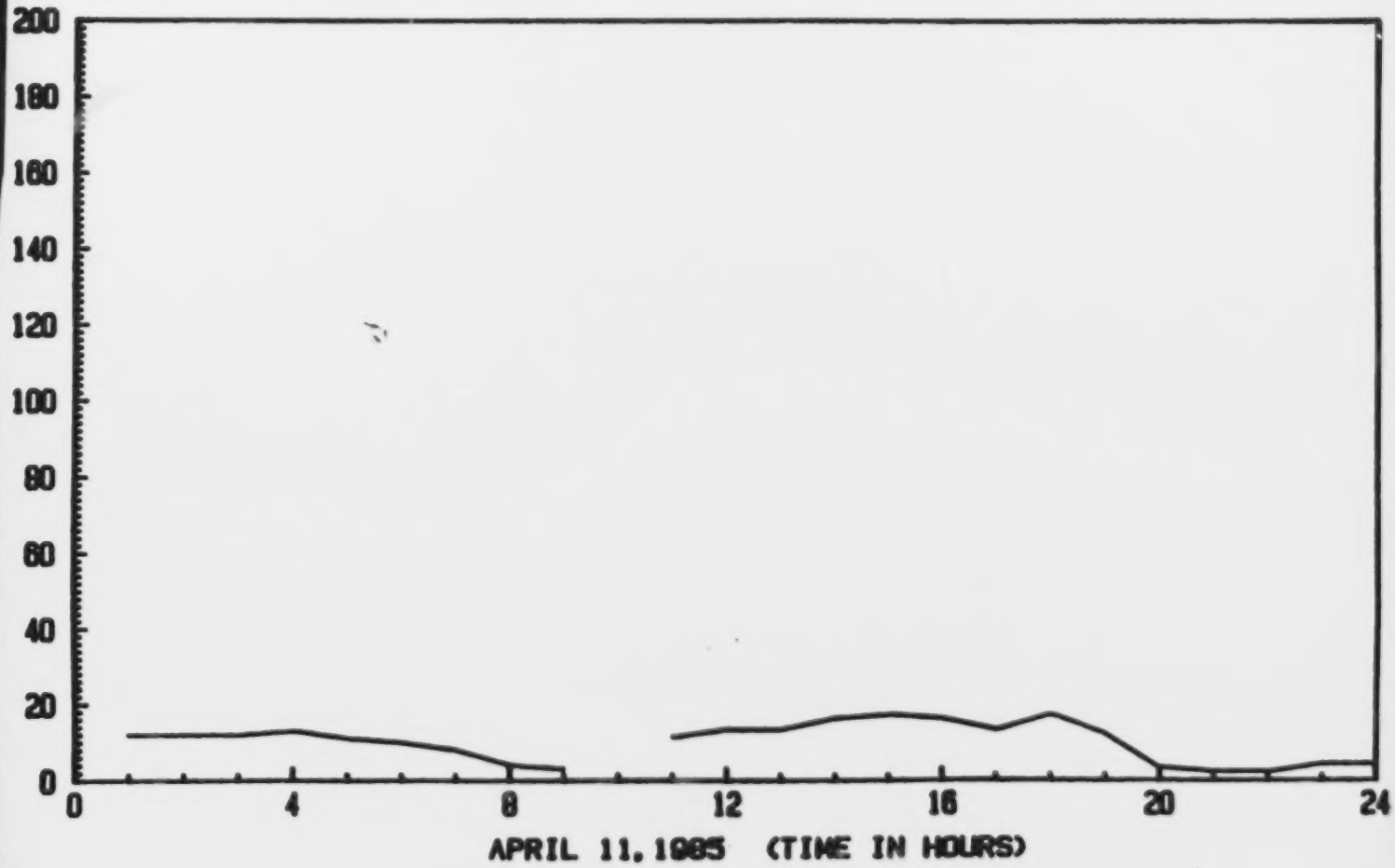
FIGURE 9.



INDOOR POLLUTANT MEASUREMENTS

FIGURE 10.

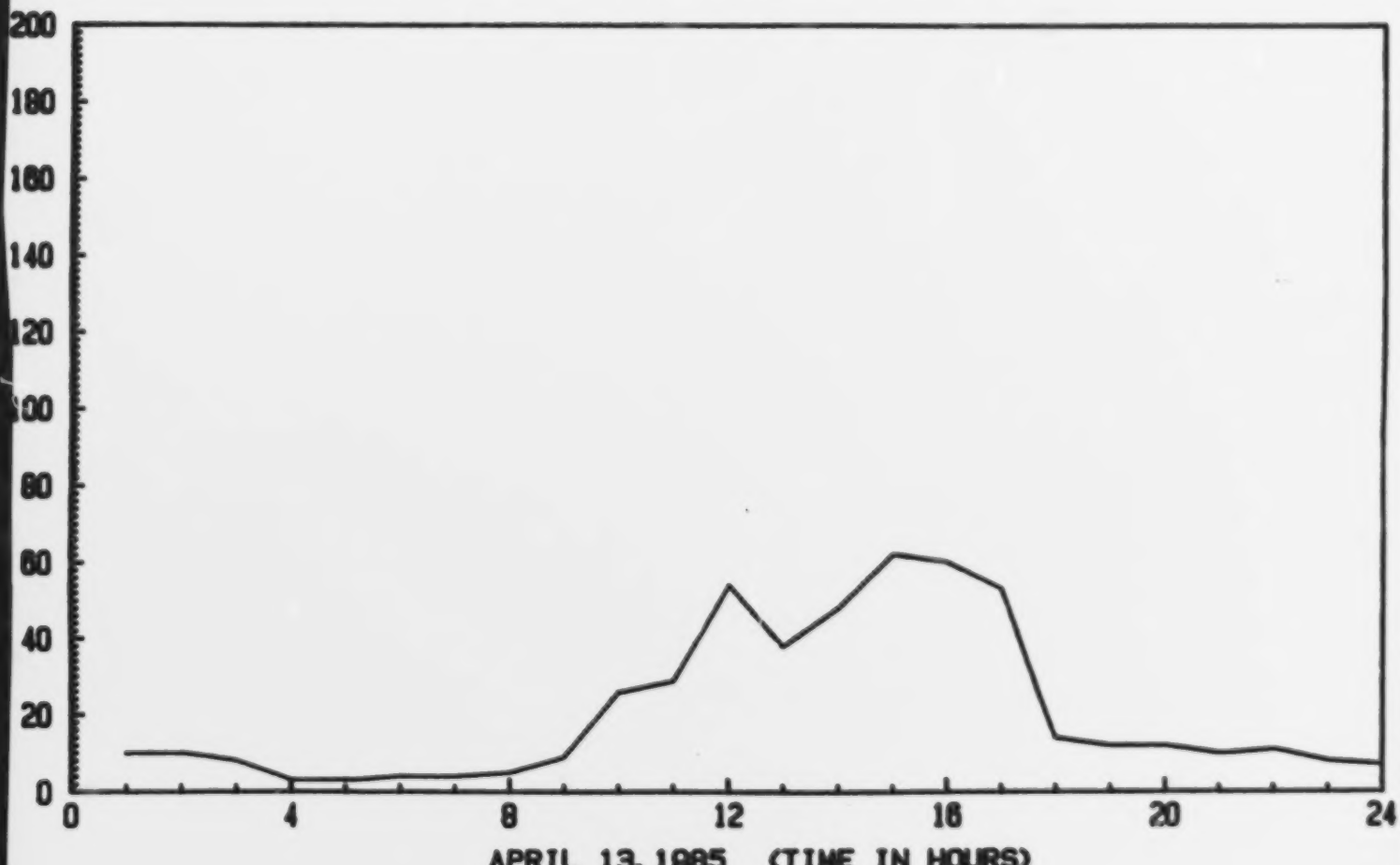
OZONE



INDOOR POLLUTANT MEASUREMENTS

FIGURE 11.

OZONE



Appendix 5

DRAFT PRESERVATION POLICY

This Preservation Policy is established for the National Library of Medicine (NLM) pursuant to the authority contained in the National Library of Medicine Act of 1956 (P.L. 84-941), which charges the Library to "acquire and preserve ... library materials pertinent to medicine." NLM has an obligation not only to provide information needed by today's health professionals but also to ensure the availability of the scholarly biomedical record for future generations.

NLM's preservation program is governed by the guidelines for selection of the biomedical literature for the NLM collection, as described in the Collection Development Manual of the National Library of Medicine. NLM's principal responsibility is to ensure the preservation of the core biomedical literature that it collects at the comprehensive level. The Library has a lesser responsibility to assist in the preservation of literature in the subjects related to medicine and health that it collects at the research level. NLM assumes no responsibility for preservation of materials in subjects it collects at the basic information level. Within these parameters NLM must ensure that the biomedical literature is preserved. The preservation of NLM's own collection is a major step toward the preservation of the entire scholarly biomedical record. NLM also has a responsibility to assist the preservation of important biomedical literature held by other U.S. institutions. NLM's preservation efforts should be coordinated with those of other national libraries, research libraries and biomedical libraries.

Subject to the coverage guidelines in the Collection Development Manual, NLM seeks to preserve biomedical literature in all formats, including printed works, manuscripts, prints, photographs, audiovisual programs, and any additional formats that the Library may acquire in the future.

Although most items in the NLM collection may be retained in the original form as long as they remain useful, NLM's primary preservation responsibility is for the content of the biomedical literature rather than its original format. The need to preserve the original format as well as the content of the literature varies depending on the nature of the literature. In general, the items in the NLM collection with high intrinsic value are rare books, manuscripts, prints, and photographs, but individual items that deserve preservation in the original format may be found throughout the collection.

Preservation of all the core biomedical literature that NLM collects at the comprehensive level is desirable and probably achievable. In assigning preservation priority to groups of material, consideration shall be given to:

- uniqueness of the material
- level of use of the material

- state of deterioration of the material
- existence of preserved originals or preservation copies at other institutions
- relationship of the material to existing cooperative preservation activities
- availability of suitable preservation methods

The NLM staff shall monitor developments in preservation techniques to ensure the use of the most cost-effective methods available and shall participate in research, development, testing, and evaluation of preservation technology. In selecting specific techniques for particular groups of material, the staff shall consider the likely future demand for the material, ease of use of the preserved originals or preservation copies, the cost and reliability of the preservation method, the cost of long-term storage of the preserved originals or preservation copies, and other factors as appropriate.

Operational guidelines and procedures for selecting items to be preserved, choosing preservation techniques, and processing items for preservation shall be detailed in a manual to be developed and amended from time to time in a manner to be determined by the Director.

Definitions:

- "Biomedical" shall mean pertaining to health care, to the practice of the science and art of medicine broadly conceived, or to those branches of life sciences which are fundamental to that science and art.
- "Literature" shall be construed to include information not only in the form of the written or printed word, microforms and graphic materials, etc., but also such non-print information formats as audiotapes, videotapes, films (both still and motion picture), slides, computer tapes, etc.
- "Preservation" is the management of library materials to ensure their availability for use by future generations. Preservation encompasses such diverse activities as maintaining an appropriate storage environment, minimizing use practices that are harmful, providing physical or chemical protection to items, and making copies of literature in archival formats.
- "Comprehensive Level" shall describe a collection in which a library endeavors, so far as is reasonably possible, to include all significant works of recorded knowledge (publications, manuscripts, other forms) in all applicable languages, for a necessarily defined and limited field.

This level of collecting intensity is one that maintains a "special collection;" the aim, if not the achievement, is exhaustiveness. Older material is retained for historical research.

NLM collects the core biomedical subjects at the comprehensive level.

- "Research Level" shall describe a collection that includes the major published source materials required for dissertations and independent research, including materials containing research reporting new findings, scientific experimental results, and other information useful to researchers. It is intended to include all important reference works and a wide selection of specialized monographs, as well as a very extensive collection of journals and major indexing and abstracting services in the field. Older material is retained for historical research.

  NLM collects these subjects it defines as <u>related</u> to medicine at the Research Level. Selections in these subjects are generally in English and selected foreign languages only. The selected foreign languages are usually French, German, Japanese, and Russian, but may vary depending on the primary centers of research in particular subject. Special language criteria, if any, are described under the individual subject.

- "Basic Information Level" shall describe a collection of up-to-date general materials that serve to introduce and define a subject and to indicate the varieties of information available elsewhere. It may include dictionaries, encyclopedias, selected editions, surveys, bibliographies, handbooks, a few major periodicals, in the minimum number that will serve the purpose. A basic information collection is not sufficiently intensive to support any courses or independent study in the subject area involved.

  NLM collects those subjects it defines as <u>peripheral</u> to medicine at the Basic Information Level. Selections in these subjects are generally in the English language only.

Appendix 6

Proposed Preservation Section: Rationale and Functions

The formation of a new Preservation Section in the Reference Services Division is considered the most suitable option for a new organizational unit for the following reasons.

1. Policy, planning, and most operational responsibilities are combined in one place so there is less potential for coordination problems and no split between the "glamorous" and "routine" aspects of the job.

2. Most preservation workers are together under a single line authority.

3. The size of LO senior staff and number of people reporting to ADLO remain unchanged.

4. The responsibilities of the Office of the Chief, RSD, remain the same.

5. The healthy tension between service demands and preservation considerations remains within RSD.

6. A new Section with responsibilities comparable to existing LO Sections can be formed within the existing LO staffing level.

Other options, including a small Preservation Office reporting directly to the Office of the Associate Director for Library Operations and a Preservation Division, appear to have significant disadvantages with NLM's current organizational context. (A discussion of the various organizational options considered by the Planning Team appears in the "Report of the Task Force on Organizational Responsibility for Preservation Activities.")

The new Preservation Section should be assigned the following responsibilities (asterisks denote functions not currently performed by any NLM unit):

Management

* 1. Coordinate the development of preservation policies (including preservation priorities, copyright implications, and use of archival copies).

* 2. Plan and coordinate preservation programs.

3. Identify budget and staffing needed.

4. Initiate and manage contract actions. (HMD will share this function.)

* 5. Evaluate effectiveness of preservation programs.

Cooperative Programs

* 6. Work with publishers to promote original publication on archival quality materials, reprinting of important works, etc.

* 7. Consult with professional societies when determining preservation priorities.

* 8. Develop cooperative preservation activities with other national libraries, research libraries (ARL, RLG, etc.), U.S. biomedical libraries (the RML network), and foreign national libraries.

* 9. Share preservation information, including what has been preserved.

Collection Maintenance

10. Bind library materials.

11. Make minor repairs.

Technical Preservation/Conservation

* 13. Monitor developments in preservation techniques, equipment, supplies and programs.

* 14. Evaluate preservation impact of equipment and supplies used in processing and service activities.

15. Monitor and control environmental conditions.

16. Select items to be preserved. (HMD will share this function.)

17. Search to determine if preservation copies already exist.

18. Preserve library materials by appropriate

methods. (HMD will share this function.)

Education/Public Information/Consultation

19. Train staff in the safe handling and processing of material.

20. Provide users with information/training on how to use material without causing unnecessary damage.

21. Provide consultation/education to other biomedical libraries, special collections in medical history, etc., regarding preservation issues and methods.

Research

22. Identify appropriate research efforts to be undertaken in conjunction with the Lister Hill Center and/or other organizations.

The following preservation functions should continue to be handled by other units:

1. Collection maintenance - storing and controlling the collections, gapping, shelfreading. (Circulation and Control Section, RSD)

2. Collection integrity and security - preventing and detecting theft, guard force orientation and liaison, disaster prevention (including fire, water damage, mutilation, vandalism, etc.). (Circulation and Control Section, RSD; HMD; OA)

3. Preservation and collection maintenance activities related to special collections (e.g., manuscripts, prints and photographs, rare books). (HMD)

4. Research related to preservation. (Lister Hill Center)

In developing the plan for implementing the new Section, care should be taken to clarify its relationship to the other units that will continue to exercise responsibility for some preservation-related activities. Tables 7 and 8 provide a summary of recommended preservation activities and budget levels for the next five years.